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STEM EDUCATION BEFORE HIGH SCHOOL: SHAPING OUR FUTURE SCIENCE, TECHNOLOGY, ENGINEERING AND MATH LEADERS OF TOMORROW BY INSPIRING OUR CHILDREN TODAY

FIELD HEARING

BEFORE THE

COMMITTEE ON SCIENCE AND TECHNOLOGY
HOUSE OF REPRESENTATIVES

ONE HUNDRED TENTH CONGRESS

SECOND SESSION

MAY 12, 2008

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STEM EDUCATION BEFORE HIGH SCHOOL: SHAPING OUR FUTURE SCIENCE, TECHNOLOGY, ENGINEERING AND MATH LEADERS OF TOMORROW BY INSPIRING OUR CHILDREN TODAY

MONDAY, MAY 12, 2008

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
Washington, DC.

The Committee met, pursuant to call, at 1:17 p.m. At the Martha and Josh Morriss Mathematics and Engineering Elementary School, Texarkana, Texas, Hon. Bart Gordon [Chairman of the Committee] presiding.

BART GORDON, TENNESSEE
CHAIRMAN

RALPH M. HALL, TEXAS
RANKING MEMBER

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Committee on Science and Technology

STEM Education Before High School: Shaping our Future Science, Technology, Engineering and Math Leaders of Tomorrow by Inspiring our Children Today

May 12, 2008
1:00 PM – 3:00 PM
Martha and Josh Morriss Mathematics and Engineering Elementary School,
Texarkana, TX

Witnesses:

Dr. Cora Marrett
Assistant Director, EHR Directorate
National Science Foundation

James Henry Russell, CPA
Superintendent of Schools
Texarkana Independent School District

Rosanne Stripling
Provost and Vice President for Academic Affairs
Texas A&M University-Texarkana

Mike Leherr
Alcoa
Plant Manager- Texarkana

Mr. David Smedley
North Heights Junior High School - Texarkana, Arkansas

FIELD HEARING CHARTER

COMMITTEE ON SCIENCE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

STEM Education Before High School: Shaping Our Future Science, Technology, Engineering and Math Leaders of Tomorrow By Inspiring Our Children Today

MONDAY, MAY 12, 2008
1:00 P.M.–3:00 P.M.
MARTHA AND JOSH MORRISS MATHEMATICS AND
ENGINEERING ELEMENTARY SCHOOL
TEXARKANA, TEXAS

1. Purpose

On Monday, May 12, 2008, the Science and Technology Committee will hold a field hearing in Texarkana, Texas, to receive testimony on efforts to engage students in math and science at an early age, to keep them interested throughout middle school and high school, and to translate that interest into rewarding careers that will be of benefit to the entire Nation from a federal, school district, university, industry and teacher perspective. Further, we will examine the efforts behind and reasons for the establishment of a STEM-based public elementary school and the progress that it is making with its students, which could serve as a model for the Nation.

2. Witnesses

- **Dr. Cora Marrett,** Assistant Director for the Education and Human Resources Directorate, National Science Foundation (NSF), Washington, DC
- **Dr. Rosanne Stripling,** Provost and Vice President for Academic Affairs, Texas A&M University-Texarkana, Texarkana, TX
- **Mr. James Henry Russell,** Superintendent, Texarkana Independent School District, Texarkana, TX
- **Mr. David Smedley,** Science Teacher, North Heights Junior High School, Texarkana, AR
- **Mr. Mike Leherr,** Plant Manager, Alcoa-Texarkana, Texarkana, TX

3. Brief Overview

- A consensus exists that improving science, technology, engineering, and mathematics (STEM) education throughout the Nation is a necessary, if not sufficient, condition for preserving our capacity for innovation and discovery and for ensuring U.S. economic strength and competitiveness in the international marketplace of the 21st century. Many reports, including those from the Council on Competitiveness, Business Roundtable, and the National Academy of Sciences' *Rising above the Gathering Storm,*[1] placed a major emphasis on strengthening STEM education in the United States to ensure that the Nation's workforce can compete globally in high-tech, high-value industries, such as information technology, biotechnology, semiconductor manufacturing, and nanotechnology. The President addressed these needs in his American Competitiveness Initiative and Congress, likewise, in the *America COMPETES Act,* which is now law (Public Law 110–69).

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[1] *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future,* National Academies Press, Washington, D.C. (2006).

- Historically, NSF's mission has included supporting and strengthening science and math education programs at all levels. In the area of K–12, NSF carries out its mission by funding a variety of science and math education activities, including teacher training (both in-service and pre-service), curriculum development, education research, and informal education at museums and science centers.
- Critical transitions occur as students move from elementary schools to middle schools, from middle schools to high schools, and from high schools to post-secondary education. International data show corresponding shifts in students' achievement rankings internationally, where performance of U.S. students relative to that of students around the world generally drops from fourth grade to eighth grade, and then drops further in high school. And, the curriculum in mathematics and science may reflect significant jumps in complexity and demand as these critical transitions occur. For example, elementary school students who have been studying concepts and procedures in the area of numbers increasingly must meet the challenge of studying algebra in the middle grades. A related consideration that comes with the critical transitions is that students' interest in the STEM fields, and their enthusiasm for mathematics and science, also may decrease as they move from the elementary grades, to the middle grades, and beyond. Teachers have enormous responsibility to support students' growth and competency, stimulate their interest and enthusiasm, and ensure that they are prepared for assessments and higher level work in subsequent grades.
- The Martha and Josh Morriss Mathematics and Engineering Elementary School in Texarkana, Texas, is part of a vertical aligned K–16 engineering education collaborative between Texas A&M University-Texarkana and Texarkana Independent School District. It provides mathematics and pre-engineering integrated curriculum and pre-engineering electives for students in kindergarten through fifth grade. Students graduating from the elementary school will be able move into an advanced Math and Science program at Texas Middle School. This school serves as a national model for K–16 collaboration in how young children can become engaged in and educated for careers in mathematics and engineering.

4. Background

K–12 Science and Math Education at the National Science Foundation

Science and math education is a cornerstone of the historic mission of the National Science Foundation. The *National Science Foundation Act of 1950,* which established NSF, directed NSF to support and strengthen science and math education programs at all levels. NSF carries out its K–12 mission by supporting a variety of science and math education activities, including teacher training (both in-service and pre-service), curriculum development, education research, and informal education at museums and science centers.

Examples of NSF programs designed to improve teacher performance, enhance understanding of student retention of scientific content, and develop and assess curricula include the Centers for Learning and Teaching, which provide professional development opportunities for K–12 teachers; the Advanced Learning Technologies program, which supports cognitive science research on the use of technology to enhance learning and teaching; and the Instructional Materials Development program, which supports the development of curriculum as well as research into the most effective means of teaching math and science material.

In addition to these programs, other NSF education programs focused on improving K–12 education include the Math and Science Partnership (MSP) Program and the Robert Noyce Scholarship (Noyce) Program, both reauthorized as part of the *America COMPETES Act.* The MSP Program funds partnerships between universities and local school districts to strengthen the science and math content knowledge of K–12 schoolteachers. The grants are awarded to support the creation of innovative reform programs that could be expanded to the State level if successful. The Robert Noyce Scholarship Program is designed to help recruit highly-qualified science and math teachers through grants to college and universities to give scholarships to science and math majors in return for their commitment to teach at the elementary or secondary school level. America COMPETES strengthened and expanded the Robert Noyce Teacher Scholarship Program to provide scholarships to students majoring in science, math or engineering who commit to teaching two years in return for each year of aid. The program provides money to colleges and universities both to award and administer the scholarships and to provide programs to help prepare the students for teaching. The expansion of this program was modeled on the UTEACH program at the University of Texas.

Texas A&M University–Texarkana and Texarkana Independent School District Pre-K–16 Collabortive[2]

Texas A&M University-Texarkana and Texarkana Independent School District established a vertically aligned kindergarten–16 engineering education collaborative that will be executed in four stages: (1) a K–5 public elementary school (Martha and Josh Morriss Mathematics & Engineering Elementary School) that provides a mathematics and pre-engineering integrated curriculum, "Engineering Encounters" (culminating projects), and pre-engineering electives (i.e., circuitry, forces and gears) at each grade level (opened fall 2007); (2) a pre-engineering "school-within-a-school" at Texas Middle school (planned for fall 2008); (3) selected mathematics and science courses with pre-engineering content enrichment and dual credit engineering courses at Texas High School (fall 2006); and (4) a choice of three engineering related programs of study at A&M–Texarkana: BS in Computer and Information Sciences (fall 2005), BS in Electrical Engineering (planned for fall 2008), and BS in Mechanical Engineering (planned for fall 2010).

The overarching goal of the engineering collaborative is to increase the quantity and quality of United States grown and educated engineers. The goal will be accomplished by exposing young children to exciting mathematics and engineering concepts and providing a rigorous and seamless pre-engineering and engineering education curriculum through the completion of a baccalaureate degree. A growing gap between the supply and demand for professionals in engineering and mathematics careers has alerted stakeholders across the Nation. The regional need for more engineers was documented in the late 1990s when Texarkana area businesses (e.g., International Paper, Domtar Paper Mill, and Alcoa) identified the need for an engineering program at A&M–Texarkana as the number one community priority. Their expressed need has been manifested in contributions of almost $7 million to date for an engineering degree program at the university.

Although the effectiveness of a K–16 engineering collaborative as a means of ameliorating the supply and demand gap of engineers is a very logical, research-based approach, a comprehensive search has not identified another partnership of this kind across the United States. The Texas A&M University–Texarkana ISD K–16 engineering collaborative is a unique, sustainable, and replicable model that sets a gold standard for how public schools and universities can maximize the investment return on human and financial resources to attain an important and shared goal—to "close the gap" between participation and success in secondary and higher education in a manner that effectively addresses a growing professional and career demand if the United States is to continue its position as a global power—engineering and mathematics.

The Martha and Josh Morriss Mathematics and Engineering Elementary School[3]

The Martha and Josh Morriss Mathematics and Engineering Elementary School, serving children in grades K–5, is the eighth elementary school in Texarkana Independent School District opened in the fall of 2007. The school does not have an attendance zone, and any elementary-aged student living in the State of Texas is eligible to apply for enrollment on a first-come basis without charge. Once a student has been accepted for enrollment, certain academic and behavior standards are required for continued attendance. The school is designed for approximately 396 students (three sections each in grades K–5). As of September 30, 2006—eleven months prior to the opening of the new school—100 percent of the available positions at grades K–4 and 89 percent at grade 5 were committed, with 49 percent of the student enrollment to date being female. A waiting list has been established for most of the primary grades, and over 80 kindergarten applications for the 2008–2009 and 2009–2010 academic years have been submitted.

The floor plan and architectural design of the new school facilitates the delivery of an inquiry-based mathematics and engineering integrated curriculum for all subjects in grades K–5, including fine arts, foreign language, health and physical education as well as the four core subject areas. The mathematics and engineering embedded Texas Essential Knowledge and Skills (TEKS) curriculum is enhanced by "engineering encounters"—cross-grade level, theme-based authentic assessment projects completed and presented by students to the public each six-weeks (see Examples). The K–6 grade mathematics and science TEKS is accelerated into grades K–5 (and grades 7 and 8 content into the 6th grade at middle school), allowing students to take Algebra I and advanced science in grade 7 to provide opportunities for advanced mathematics, science, and engineering courses in high school. Further, engineering electives (content beyond the TEKS) will be taught at each grade level. Extended school-year enrichment activities such as a two-week summer Circuitry Camp provide a "value added" element to students' learning.

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[2] TIDS–TAMU–T K–16 COLLABORATIVE MORRISS ELEMENTARY SCHOOL (*http://www.tea.state.tx.us/p16/council_mtg_attach/presentations/feb08/feb08_regionalp16_texarkana.pdf*)

[3] *Ibid.*

Texas A&M University–Texarkana Arts and Sciences and Education faculty assist the Texarkana ISD curriculum personnel and teachers to design the mathematics and engineering integrated curriculum and electives. University faculty develop content and pedagogy courses to train the elementary teachers to deliver the curriculum using effective teaching strategies that promote mastery of the curriculum by all students. All of the Morriss Elementary teachers are required to obtain a Masters Degree and either the Texas Master Mathematics Teacher Certification or Texas Master Technology Teacher Certification through preparation programs offered at A&M–Texarkana.

The Martha and Josh Morriss Mathematics and Engineering Elementary School has become a national model for K–16 collaboration in how young children can become engaged in and educated for careers in mathematics and engineering.

5. Questions for the Witnesses

Dr. Cora Marrett

- What evidence is available from NSF-funded projects to help us better understand how students develop interests in STEM fields in the pre-K through 12 years, and how can those interests be sustained across the high school to post-secondary education transition? Are there model programs or approaches to curriculum and instruction that have demonstrated how to engage students successfully in STEM areas and that lead to choice of STEM careers? What is the role of out-of-school learning in encouraging STEM career participation? What factors affect students' choice of STEM majors or programs and their retention at the post-secondary level?
- How do NSF programs support the improvement of the teaching and learning of the STEM disciplines in the pre-K through 12 years? What programs are available to improve teachers' knowledge and abilities, and what does research tell us about the best ways to enable teachers' effectiveness in promoting learning? What types of programs and models for STEM teacher preparation, induction, and professional development show the most promise for supporting STEM teachers' learning, and what can be learned from the implementation of such programs and models?
- What instructional tools, resources, materials, and technologies has NSF supported to enable STEM learning? Under what conditions, and for whom, are such resources for learning most effective? Does research provide insight into what kinds of instructional materials and tools are most useful in supporting learning at various levels, and for various groups of learners?

Dr. Rosanne Stripling

- How was Texas A&M–Texarkana involved with the creation of the Martha and Josh Morriss Mathematics and Engineering Elementary School? What other pre-K through 12 schools does Texas A&M–Texarkana support and how? Please describe any other work or partnerships that Texas A&M–Texarkana is doing with regards to STEM education for pre-K through 12 schools.
- What are the major problems that limit the performance of students and teachers, and what do you feel is the single, most important step that the Federal Government should take to improve pre-K through 12 grade math and science education? What involvement have you had with math and science education programs at the National Science Foundation or other federal agencies as well as those in the State of Texas? What are the most important and effective components of these programs?
- How can we attract, educate and retain the critical mass of talent necessary to keep the State of Texas—and the country as a whole—at the forefront of research, development and ground-breaking advances in science and technology? In addition to providing a technically literate workforce, why is it important to improve public support and understanding of math and science?

- How can we ensure that we provide sufficient opportunities to allow students and researchers, educators and employees to become and then remain current and competitive in our rapidly evolving world?

Mr. James Henry Russell

- What is the overall state of STEM education in Texarkana? Why is it important for all students to achieve proficiency in these subjects? What was the motivation behind establishing the Martha and Josh Morriss Mathematics and Engineering Elementary School? What role did parents, the community and local businesses play in the establishment of this school? Is there a plan in place to keep these students motivated in STEM subjects as they make the transition to middle school and on to high school?
- What are the major problems that limit the performance of students and teachers, and what do you feel is the single, most important step that the Federal Government should take to improve K–12th grade math and science education? What involvement have you had with math and science education programs at the National Science Foundation or other federal agencies as well as those in the State of Texas? What are the most important and effective components of these programs?
- How can we grow and educate, attract and retain the best and brightest scientists and engineering students? What do you feel is the single, most important step that the Federal Government should take to improve pre-K through 12 STEM education?

Mr. David Smedley

- What are the major problems that limit the performance of students and teachers, and what do you feel is the single, most important step that the Federal Government should take to improve K–12th grade math and science education? What involvement have you had with math and science education programs at the National Science Foundation or other federal agencies as well as those in the State of Arkansas? What are the most important and effective components of these programs?
- How can we spark a greater student interest in math and science education? What can we do to ensure that student interest in math and science does not wane as they progress through our formal system of education? Specifically, how do you keep your junior high students motivated and excited about STEM?
- What challenges do you face in improving student achievement in math and science education? How can parents, businesses, the community, and the government better support you in your efforts to raise student proficiency in STEM?
- What elements of your pre-service or in-service training have been most helpful in meeting the daily demands of working with students, developing innovative classroom strategies, and delivering content-rich instruction to students of all levels and abilities? As a professional teacher, what partnerships or collaborations with local colleges or universities have been most helpful to you in terms of access to materials or professional development?

Mr. Michael Leherr

- Why did Alcoa choose to become involved with the creation of the Martha and Josh Morriss Mathematics and Engineering Elementary School? What other schools does Alcoa support and how? Why is it important for Alcoa to be interested in pre-K through 12 education?
- How do we avoid a disconnect between the jobs we want to keep in the U.S. and our workforce's ability to perform those jobs? How is Alcoa working with pre-K through 12 schools as well as colleges, universities and training programs to avoid that disconnect?
- Please describe what Alcoa Texarkana does? What percentage of your workforce has a STEM background? Are you able to recruit locally for these positions and if not, why not? How do you work with the local colleges and universities to support your workforce? If you have mentoring programs in place to encourage your engineers to help out in STEM classes at the pre-K through 12 levels or even in college courses, please provide information on these programs or similar activities Alcoa supports.

Chairman GORDON. Good afternoon. I'm pleased to be here in the district for this field hearing.

I have told Congressman Hall this before, but my grandfather used to tell me—I'm from Tennessee. My grandfather used to tell me every time we met the population increased, so I'm happy to have some of my relatives from Texas here today. I'm very pleased to be here, folks, with Ralph Hall and Mike Ross. I think Texarkana is well served by having a Democrat, a Republican, a Texan and a young fellow from Arkansas work together. That's how you get things done. We try and do the same thing on the Science and Technology Committee in Washington. We are something of an anomaly. I am very fortunate to have Ralph Hall as a Ranking Member.

Over the last year and a half we've passed out over 30 bills, all of which have been bipartisan, all but one unanimous, including the Pete's bill that I think is a type of role model that I hope we can show the rest of Congress. We'll all be better off to do that.

Sitting next to Ralph, he's been telling me for the last year about this school and this district. We're all proud of our own district, but he keeps saying there really is something special about the Morriss Elementary School and wanted me to come down and see it. It's been a delight to be here. Certainly, you have a wonderful facility, but really it's more than just the building. It's the attitude of the children. I hope the model that you have established here can be an incubator that we can roll out to other and scale out all across the country.

I'm looking forward to going over some time to Mike's to the Arkansas school for math and science and arts. I've heard Mike tell this a couple of times, but he was in the State Senate when this school was created. He had the legislation. He thought it was a pretty good idea until his daughter was accepted and moved away. He didn't think it was quite as good, but I think he's acclimated himself, and his son will go there soon. So, that's another good model that we want to look for.

So, I can say without qualms that I would not be Chairman of this committee if it wasn't for Ralph Hall. So, at this time I would like to pass the gavel to my friend Congressman Hall for the remainder of this hearing.

Mr. HALL. [presiding.] I thank you, and how long are you going to allow me to keep this gavel? I'll be back in Washington with you Tuesday morning, I'll give it back to you.

Of course I'm honored to be here and to have so many here for such a worthy cause and for something that we're all so proud of, to attract these men and women of industry throughout the United States and to have them here. And one in particular that's with us is, he just spoke to a very fine group, Mr. Tom Pickens. I ask that he be granted the right to be at the table and to give an opening five-minute speech as others do and to give answers to questions. Any objection? The Chair hears none.

As you all do up there in Washington, I now recognize myself for five minutes for an opening statement. I wanted to first thank our astronaut who has been wonderful with visiting with the youngsters today. Lee Archambault has been to space. He flew, I think, for 5.8 million miles in a 14-day period as the pilot of the Atlantis

Shuttle mission. He's going back. He has flown I think over 4,000 flight hours on more than 30 different aircrafts. He has been great with the youngsters today with three different groups of classes. He's answered questions. He brought them up to date on robotics. As they have been working on them in the classroom here, he showed how they used the work that they've been doing, that they were being taught at that time in space because he was a part of the crew that went up to repair a space station, and they used a robot to take a piece of the station over and put it way out to the end of the station in space there. These youngsters saw their work in action there, and I think that was great for them.

So, I want to officially welcome you, Chairman Gordon, to the Fourth District of Texas and thank you for making the journey. I think we can both agree that what we've experienced this morning was pretty impressive.

Mr. Ross, I'm going to have more to say about you in just a minute, but I'm very glad that you joined us. I can't be granted enough time to say good things about you, and I have to because he chairs about half of the sessions in Congress now. I have to stand up, and he says "What purpose is the gentleman from Texas standing?" I have to tell him and beg him to let me speak for five minutes. If I'm real nice to him in front of his own folks he ought to give me ten minutes, don't you think?

Seems like it was only yesterday that I was here in the dedication celebration of the Martha and Josh Morriss Mathematics and Engineering Elementary School. We've had them this morning. We are so proud of them. They are a giving family, a successful family, a caring family, and we're benefiting from their generosity. I know they are proud of what they have established here. It's good to see so many of my Texarkana County friends in the audience including both Martha and Josh who donated the land for the school and Scott Bruner, President of the Texarkana Independent School District Board of Trustees. Thank you.

The collaboration between Texas Independent School District and Texas A&M University Texarkana to make the Morriss School a reality is one that can and should be replicated. The concept of starting a STEM program that a student can follow from kindergarten all the way through a baccalaureate degree and all in their own hometown is very positive. It's good to see that local businesses like Alcoa and others recognize the value in supporting such an effort.

The Texarkana collaboration is a slightly different approach than what we created in America COMPETES, but we never intended for that to be the only solution. This nation's full of good visionary ideas, and the area of STEM education is no exception. I look forward to hearing from Dr. Marrett about some of the other ideas NSF is funding on the federal level as well as how Mr. Smedley is motivating some of his own students in Arkansas. Inspiring our children about math and science at an early age is important. Keeping them enthusiastic as they progress through middle school and high school and into college is critical.

As I said at the school dedication last September, advancing STEM education must be a national priority if we are to prepare our students for 21st century jobs and keep pace with countries like China and India who are graduating larger number of STEM students. They may be graduating more, but the quality of ours remains unsurpassed in this world. America has always been the leader in cutting-edge technology and innovation, and we have to do all we can do to insure a strong footing as a global economic leader. I appreciate all of you witnesses being here today. I know it took you time to get here and took you time to prepare for being here. Thank you for giving us the time that you're giving. I look forward to your testimony.

At this time I turn to my colleague Mr. Gordon, the distinguished Chairman of the Committee, and recognize him for any other opening remarks he might want to make.

Chairman GORDON. Thank you, Mr. Hall.

[The prepared statement of Mr. Hall follows:]

PREPARED STATEMENT OF REPRESENTATIVE RALPH M. HALL

First, I want to officially welcome you, Chairman Gordon, to the fourth district of Texas and to thank you for making the journey and spending the entire day with us. I believe we can both agree that what we experienced this morning was pretty impressive.

It seems like it was only yesterday that I was here for the dedication celebration for the Martha and Josh Morriss Mathematics and Engineering Elementary School. I know these folks are proud of what they have established here, and it's good to see so many of my Texarkana friends in the audience, including Martha and Josh Morris, who donated the land for the school, and Scott Bruner, President of the Texarkana Independent School District (TISD) Board of Trustees.

The collaboration between TISD and Texas A&M University–Texarkana to make the Morriss School a reality is one that can and should be replicated. The concept of starting a STEM program that a student can follow from kindergarten all the way through a baccalaureate degree, and all in their home town, is very positive. It is good to see that local businesses, like Alcoa, recognize the value in supporting such an effort.

The Texarkana collaboration is a slightly different approach than what we created in America COMPETES, but we never intended for that to be the only solution. This nation is full of good visionary ideas, and the area of STEM education is no exception. I look forward to hearing from Dr. Marrett about some of the other ideas NSF is funding on the federal level, as well as how Mr. Smedley is motivating his own students in Arkansas. Inspiring our children about math and science at an early age is important. Keeping them enthusiastic as they progress through middle school and high school and into college is critical.

As I said at the school dedication last September, advancing STEM education must be a national priority if we are to prepare our students for 21st century jobs and keep pace with countries like China and India who are graduating larger numbers of STEM students. They may be graduating more, but the quality of ours remains unsurpassed in the world. America has always been the leader in cutting edge technology and innovation—and we must do all we can to ensure our strong footing as a global economic leader.

I appreciate all of our witnesses being here today and look forward to your testimony.

Chairman GORDON. Let me concur with your remarks. Also, I thank the witnesses here. Colonel Armstrong, you might be in a situation some time in the future, some of you probably know that Congressman Hall was a fighter pilot during World War II, and they had a reunion in Washington with some of the other folks that he flew with at that time. They were talking there and I overheard them, and one of them said it sure was windy, and the next one says, no, it's Thursday. And Ralph said I'm thirsty too. Let's go out and get a beer.

In all seriousness, this is a very important program for us to learn from. There is six and a half billion people in the world, half of which make less than two dollars a day. We do not want to compete in that regard. If we do, my seven-year-old daughter could be the first generation of Americans to inherit a national standard of living less than their parents. So, what we've got to be able to do is we've got to make 20 or 30 or 50 widgets for every one they're making in China and India and elsewhere. To do that, we have to work at a higher skill level, whether you're a high school graduate or junior college or a college graduate. And that means you have to have a background in STEM, and we're not doing well in that.

Here in the United States among the OECD city countries, those of industrialized countries in recent scores we were 21st out of 30 in science and 25th out of 30 in math. That's not what we're used to in this country, and we have to do better, which means we've got to look at the type of programs here at the Morriss Elementary and scale that out. I'm anxious to learn more about how you got the vision, how you enacted it, and how we can take that to other places. So, thank you, Mr. Hall.

Mr. HALL. Thank you, Mr. Chairman.

[The prepared statement of Chairman Gordon follows:]

PREPARED STATEMENT OF CHAIRMAN BART GORDON

Good afternoon. It is with great pleasure that I welcome my fellow Committee Members and our distinguished panel of experts to the Martha and Josh Morriss Mathematics and Engineering Elementary School, here in Texarkana, for what will undoubtedly be a valuable discussion on STEM education before high school.

Last August, Congress passed and the President signed into law the *America COMPETES Act.* A response to the 2005 National Academies' report *Rising Above the Gathering Storm,* and supported by a wide range of U.S. industries, universities, and science organizations, COMPETES seeks to ensure U.S. students, teachers, businesses, and workers will continue leading the world in science, innovation, research, and technology.

As we all know, the global marketplace continues to become more competitive. The fact of the matter is, our country cannot and should not compete with the rest of the world on wages when half of the world's workers earn less than two dollars a day. Our country needs to compete at a higher level—with better skills and higher productivity.

But today, America is falling behind other countries in educating our kids in STEM fields, and American students continue to score below average on math and science tests. According to the latest OECD Program for International Students Assessment, or PISA, students in the U.S. ranked 25th out of 30 developed countries in math and 21st out of 30 developed countries in science.

The *America COMPETES Act* seeks to reverse this trend and ensure not only that our nation will produce the world's leading scientists and engineers but also that all students will have a strong grounding in math and science and are prepared for technical jobs in every sector of the economy.

I look forward to hearing testimony today from our witnesses on this subject. Having had the opportunity today to tour the Martha and Josh Morriss Mathematics and Engineering Elementary school I look forward to learning more about its establishment as a STEM-based public elementary school, and the progress it is making with its Pre-K through 12th grade students here in Texarkana.

Mr. HALL. At this time, I recognize Mr. Ross who shares Texarkana with me; we work well together. He's a Democrat, and I'm a Republican, but we put aside all those things when something for the good of this city or good of Bowie County or for the good of any part of Arkansas. My mother is from Cave City, Arkansas. My Administrative Assistant Janet Poppleton. Where are you, Janet? Stand up. She's the head of the Fourth Congressional District in my office in Washington and the offices here in Texas. I'm very proud to have her and very proud to have Marjorie and Eric. Thank you for what you do here for me in Texarkana.

Mr. Ross is the Congressman of District 4 over in Arkansas. Let me tell you a little about him. He presides more often probably than anyone else up there other than the Speaker herself. It seems that any time there is really a tough situation or anything that's agonizing, I look up there and she has Mike in that chair, and there's some reason for it. It's because he's very good at it. He's very fair, and he makes things happen.

So, Mike, here in the presence of your people, you grew up here, you went to school here, highly recognized, highly appreciated here, and I say to you personally I'm honored to get to work with you, and I'm always proud when I see you in the chair. Of course, I'll be more proud when the situation changes up there and maybe I'm the Chairman and Bart's the Ranking Member, but, you know the facts of life are that one of these days, the status we're in, the situation we find ourselves, the attitude that other people of the world have about the United States of America, some things are going to have to change.

That means we're going to have to forget we're Republicans or Democrats, liberals or conservatives, whatever we might be and remember that we're Americans, and put those youngsters first that we saw this morning, that our astronaut engaged in and gave his time to this morning. If he's still here, let me have him stand up again. Lee, please stand up here for us.

He is going back in just a couple, three or four months, and I believe every student he talked to today is going to follow him with their interest and with their prayers. When you have to leave, Lee, we understand you have a flight at 3:00, and we know when you get up and walk out it's not because the Chairman here said something you didn't like. It's because you have to catch that airplane. We honor you for it. You've helped us more than you know. God bless you and thank you.

I just practically said everything that Mike Ross wrote out for me. No, it was from my heart, and I'm honored to recognize the Congressman for as long as you want. Normally, we ask you to hold it down to five minutes.

Mr. ROSS. Normally we're not in Texarkana, right? I'll be brief. Thank you Congressman Hall for that generous introduction. I've got to tell you that Ralph and I have kind of a special relationship. He may be a Republican and I may be a conservative Democrat, but we work together. Quite frankly, if we had more folks doing that in Washington, we'd be getting a lot more done for the American people.

Ralph and I not only share Texarkana but we're also on the Science Committee together as well as the Energy and Commerce Committee together. In fact, Chairman Gordon is also on the Energy and Commerce Committee. We work very close together on a lot of issues, and I want to thank the Chairman for making the trip, the gentleman from Tennessee for making the trip and being here with us today in Texarkana.

I was explaining to Chairman Gordon a little bit about how Texarkana operates. You know, you get on State Line Avenue and you head south and everybody on the right hand side of the road votes for Ralph and buy lottery tickets, and everybody on the left hand side of the road can vote for me and buy whiskey, and you can't do either one on the other side of the road. That was the best way I knew how to explain the twin cities that we have here, but this is a special place for me.

I was born here. I met my wife while we both were attending Texarkana Community College. She is from here, from the Texas side. We were married here. While I represent 150 towns in nearly half the state, this is like home. We live just up the road in Preston, Arkansas. Chairman Gordon, when you live in a small town like I do, you come to Texarkana to either have a baby or see a movie, and we've done both. We've done the latter more than we've done the former. My son Alex was born here May 14, 1992. Y'all can do the math on that and quickly figure out that this Thursday is not a day I will be looking forward to; he will be 16.

Also, I have a close tie here in that my Chief of Staff in my Washington office grew up here, was educated here in the Texarkana/Arkansas Public School system and is a Texarkana native. Chairman Gordon invited me to be part of an official delegation back in January to travel to the South Pole, a place that only 35,000 people have ever been. After I completed that I felt like an astronaut, and Gabby Gifford who is a Member of Congress is actually married to an astronaut. I was sharing with her about my experience and how it took 60 hours to get there. You literally feel like you're on another planet. She went home and discussed that with her astronaut husband. I said what did he say. She said to tell you it doesn't take 60 hours to get to the places that I go.

One of the reasons I went there is I came back and I wrote a letter to every science teacher in my district giving them websites and other information trying to encourage them to encourage their young people to get involved in the maths and sciences. The reason is quite simple. You know, when President Kennedy set out to put a man on the Moon, in today's dollars we invested 90 billion. We did a lot more than put a man on the Moon. We grew a new generation of innovators in this country that have gone on to create a lot of technologies that we're now beginning to take for granted. I believe it is past time for us to grow a new generation of innovators in this country that can create the jobs of the future that can allow us to reduce our dependence on foreign oil and become more energy independent on home-grown fuels. I believe one of the ways to do that is to focus once again on the maths and sciences. That's why it is so fitting that today we are here at the Martha and Josh Morriss Mathematics and Engineering Elementary School.

I see some folks from the Morriss family here. I want to thank y'all for your commitment to the maths, sciences and engineering and the great things that you are doing here. For the sake of—just so the Chairman can get an idea, it's probably not as many as I'd want, if you live on the Arkansas side, if you'll stand up. We want to recognize those who have made a trip to be a part of this today.

Chairman GORDON. Ask if they bought a lottery ticket while they're here.

Mr. ROSS. Brittany Esterson is a former member of the Arkansas Highway Commission and a dear friend, and Steve Harrelson. Stand up, Steve. Steve is a State Representative for the Arkansas side and the majority leader in the State House of Representatives in the Arkansas. We're delighted to have him with us today. With that, Mr. Chairman, I'll submit my written statement for the record since I got a little carried away. In the sake of time I'll submit my written statement for the record and give back the balance of my time.

Mr. HALL. Thank you. They will be of record. Without objection they will be put to the record.

[The prepared statement of Mr. Ross follows:]

PREPARED STATEMENT OF REPRESENTATIVE MIKE ROSS

I would like to first thank Chairman Gordon and Ranking Member Hall for holding today's hearing and all of the witnesses who have come today to discuss Science, Technology, Engineering, and Mathematics education, also known as STEM education. I would also like to thank all of you for attending today and for your service and dedication to our children's education. It is an honor to be here to discuss this important topic and I am hopeful that today's hearing can provide a forum to discuss ways that we can work together to encourage our youth to pursue these fields of study.

As the son of two public school educators and the father of two children attending public schools and universities, I have seen first hand how important our education system is and I strongly believe that providing America's children with a world class public education is critical to our nation's future. Decades ago when President Kennedy worked to put a man on the Moon, our nation's investment in research, technology, and education was unprecedented. This resulted in raising a new generation of innovators. I believe that we can do that again by supporting and encouraging major investments in STEM education. Today's students will be tomorrow's innovators, which will help strengthen our economy, create new jobs here at home, and help America compete in this new global economy.

STEM education is responsible for our nation's technologically proficient workers, as well as our scientists and engineers, who will keep our nation on the cutting edge. As a member of the House Science and Technology Committee and the House STEM Education Caucus, I am personally involved with these issues on a daily basis. However, I am proud to help host this hearing today to foster more discussion on the local level about STEM Education and the possibilities that it can bring.

As many of you know, our nation's future competitiveness in the global economy depends upon the ability of our schools to prepare students in mathematics and the sciences and I am hopeful that today's hearing can help us determine the best ways to shape and inspire those leaders of tomorrow. Again, thank you all for coming today and for participating in this important discussion.

Mr. HALL. Mr. Chairman, and also Mike, I ask unanimous consent that Tom Pickens be added to the group who will give testimony. We will not ask him to give a five-minute opening statement as the others will because he just made a good 15- or 20-minute speech to a group at lunch. So we'll waive that for you, Tom.

Introducing those of you who are going to give us testimony, I've already thanked you for it. Dr. Cora Marrett is Assistant Director for the Education Human Resources Directorate at the National Science Foundation. To have someone of your status to come here for this today, Dr. Marrett, I appreciate you making the trip from Washington. Go back up there and get them all straightened out. We're very honored to have you here. We look forward to your testimony.

Dr. Rosanne Stripling is Provost of Texas A&M University of Texarkana. She and her husband, Dr. Larry Sullivan, who is the former Superintendent and now City Manager, he and I have had a lot of talks about him being a City Manager. I described to him what a city manager was, how they were like a B–17 rear gunner was when they flew over Germany. They were removed—the gunnery was removed after every flight. I hope that this city manager isn't like a lot of other city managers, that he gets moved after every thrust.

We have a super City Manager. He's doing a good job. The city ought to really be proud of him and thankful to him. He led up to the provisions that we are enjoying here today and the youngsters that are being educated.

I thank Dr. Stripling and her husband Dr. Larry Sullivan who served again as City Manager, worked together to create the vision for K–12 STEM education, and were very instrumental in helping to bring all this to fruition, and we thank you and look forward to your testimony.

Mr. James Henry Russell, Superintendent for Texarkana Independent School District, is also doing a tremendous job. We look forward to him giving us the same leadership that he took over. We are honored to have you there.

Dr. David Smedley is a science teacher at North Heights Junior High School on the other side of the state line. I understand North Heights is a NASA Explorer School which ties in nicely with our visit this morning. We thank you and appreciate you.

Mr. Michael Leherr is the Plant Manager for Alcoa which I think is the largest local employer in Texarkana; very generous with the school district and with other worthwhile projects in this area. We're thankful to have you as one of ours.

As our witnesses know and have been told, spoken testimony is limited to five minutes each. We're not going to get the hook at you if you go five and a half minutes or fuss at you. We sure won't fuss if you only use three minutes. Each of the Committee Members will have five minutes each to ask questions, so we'll start with Dr. Marrett.

STATEMENT OF DR. CORA B. MARRETT, ASSISTANT DIRECTOR, DIRECTORATE FOR EDUCATION AND HUMAN RESOURCES, NATIONAL SCIENCE FOUNDATION (NSF)

Dr. MARRETT. Thank you very much. Thank you Ranking Member Hall, Chairman Gordon and Representative Ross for holding this hearing and inviting me to participate.

I do so on behalf of the National Science Foundation. As you know, this federal agency, NSF, strives to promote knowledge about learning in science, technology, engineering and mathematics or STEM and strives to support interventions that build on the best of the knowledge.

Your legislative actions enrich the portfolio of NSF, as do the activities of the people I am pleased to join with you today here in Texarkana.

The emphasis of the hearing really reflects three concerns: student interest in science technology, engineering and mathematics (STEM); the teaching corps for STEM education; and resources for that education. But, in fact, the three are interrelated. For student interest alone does not shape achievement and career choices. Experiences with teachers matter significantly, but mere entry into teaching cannot guarantee teaching excellence.

First rate professional development programs are essential, but professional development programs in the absence of well-defined and well designed tools and resources are insufficient.

With reference to the three themes, the three concerns, I can only introduce today some of the evidence that supports the conclusions I just described about student interest, professional development, and tools for learning. Let me note one bit of evidence, however, that comes from the National Longitudinal Studies of American Youth or LSAY. This is a project that NSF first supported in 1989, and it sheds light on the issue of student interest.

There is a slide here that shows some results of this study that has, in fact, followed students for some time. This particular slide shows that in general, students are no more likely to like or dislike science and mathematics than they are their other subjects. In fact, that's what these scores all represent. They are basically the same across all of the disciplines. This is for students in the eighth, tenth and twelfth grade as the slide indicates.

The LSAY, though, has also followed students into their college years. Consider the results for students who were traced from the time they were sophomores into their college years. These are students who were asked in the tenth grade about whether they had some interest in science, no interest in science, all the way up to liking science and the extent of their interest. Those who expressed the highest interest in science, those receiving a score of four were, in fact, more likely to choose majors in the STEM areas in college than were other students.

But what is quite interesting is that few of the students in any of the interest groups were inclined to major in the sciences. This is a part of the evidence that attitudes alone do not shape career trajectories. There are things in addition that must be considered.

This leads us, then, into the importance that teachers and teaching must have. In fact, the findings on teachers have redirected our attention away from the attributes of teachers to the teaching conditions that affect student learning. We are now much more concerned about how and what students learn than simply about the background of teachers.

Let me give just one example from a study. This is a study the Foundation has supported, Learning Mathematics for Teaching or LMT. The study developed an instrument to measure the knowledge and skills of teachers. It then measured the performance in mathematics of the students of those teachers. The outcome: the higher the performance of the teachers on that particular test, the better the scores of the students on the test that they were given.

This held up even when the study took account of differences in the performance of students on prior tests and differences in the background of teachers. When we see then that the kind of knowledge that the teachers have can translate into the performance of students, a question becomes, what enhances the knowledge of the teachers themselves?

It is now evident that professional development programs can be designed to advance learning by teachers and as a consequence have demonstrable effects on student learning. Yet, I suggested it's not enough to have interested students; students must have the qualified teachers who can enhance the learning, but that for teaching and for the teaching effectiveness we know that resources, tools and resources make a difference.

NSF has in fact supported the development of materials and resources to accelerate student learning. Those tools, in turn, have been assessed to determine what is their viability under different kinds of conditions.

I'll just mention a few of the kinds of tools that have been developed. One is called the Cognitive Tutor. This is actually a software package that provides personalized instruction for students. It's been used very extensively in mathematics teaching, and in fact with the assessment we know that's the reason why the tutor has now been introduced to over 500,000 students in some 2,600 schools across the country.

There is also the tool SimCalc Math World. I know, quite a mouthful. The SimCalc Math World has technical materials and software for teaching core concepts in algebra. Rigorous evaluations of the curriculum show how effective it is in enhancing an understanding particularly of complicated matters that students often struggle with in algebra, including linear functions.

Finally, among the tools and the assessment is Engineering is Elementary. This is a curriculum that integrates engineering technology concepts and skills with elementary science, reading, mathematics, and social studies. And the research has been conducted in places that have used Engineering is Elementary. Such research has shown that students who use these materials gain in their understanding of engineering and science concepts and especially they come to understand a lot better what engineers actually do.

In general, then, and in conclusion, what we see from the body of work is that there are the conditions that are interrelated. Yet, there are other things that need to be pointed out. The best of teachers, and the best of resources cannot produce learning if students are not in the relevant courses.

Recognizing this, one district or state after another has raised requirements in mathematics and science for high school students. And certainly Texas exemplifies this trend of raising the requirements. Noteworthy too are efforts to encourage strong STEM content in the early school years. These efforts echo what we are finding in other nations whose students excel in international math and science comparisons. In those nations, we know that the students get an introduction into the fundamental concepts early in their careers, early in the school years; there is no waiting until high school and beyond.

Thus, the National Science Foundation stands ready to act in partnership with all who want to improve STEM education in the United States. Our experiences show that knowledge can be advanced through solid research, and that knowledge can be used in the service of STEM education improvement. We are prepared then to work in partnership with all who share the goal of ensuring excellence and quality for STEM education. Thank you.

Mr. HALL. We thank you.

[The prepared statement of Dr. Marrett follows:]

PREPARED STATEMENT OF CORA B. MARRETT

Chairman Gordon, Ranking Member Hall, and Representative Ross, thank you for inviting me to participate in this hearing on science, technology, engineering and mathematics (STEM) education. The National Science Foundation (NSF) is committed to promoting excellence in STEM education. We are fortunate to have that same level of commitment to excellence from you, as is evident from your legislative actions and your continued interest in inspiring our youth to pursue STEM careers.

The hearing today reflects three overarching concerns: (1) the conditions prompting student interest in and pursuit of careers in science and engineering; (2) the circumstances enhancing excellence in teaching and learning in STEM; and (3) the tools, resources, materials and technologies linked to effective STEM teaching and learning. Over the years, NSF has funded projects addressing all three areas. It has also aggregated information on STEM education, drawn from activities funded by other agencies and foundations as well as by NSF. That information provides a useful backdrop for this hearing on student interest, teacher enhancement, and high-quality resources. This testimony generally does not address the criteria laid out in the ACC.

What we think we know about students:

- Course-taking, not mere interest, contributes to STEM learning. The completion of challenging courses has links to performance, particularly on tests of achievement. The evidence is especially strong in the case of pre-college mathematics.
- Enrollment in advanced courses during the secondary school years influences the selection and completion of STEM majors during college.
- Nationally, the trend is toward greater participation of secondary school students in advanced mathematics and science courses.

What we think we know about teachers:

- Students learn more from mathematics and science teachers who have strong content knowledge and pedagogical skills than they do from teachers who lack these attributes. The skills are more often found among experienced than novice teachers.
- Most mathematics and science teachers in public middle and high schools participate in professional development activities.
- Teacher effectiveness rises with a less chaotic environment, greater support from administrators and colleagues, and more adequate teaching and learning resources.

Students

NSF's STEM education research and development portfolio underpins these overall general findings and offers insights into the processes under-girding them. The Longitudinal Study of American Youth (LSAY) is quite relevant to the issue of student interest, performance, and achievement. Launched in 1989, the LSAY has tracked pre-college students over time to determine their interest in mathematics and science and the subsequent choices they make. Table 1 is a summary of attitude changes among high school students. It shows that in general students are no more likely to like or dislike science and mathematics than they are other subjects, as evidenced by similar mean scores.

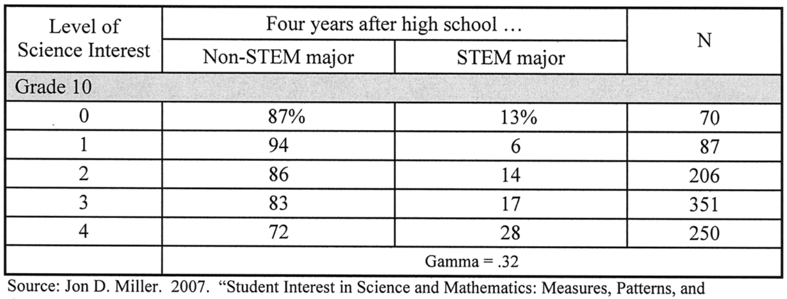
Table 1. Student Liking of Science, Mathematics, Social Studies and English Courses for selected grades.

Grade	Mean scores on liking the subject matter of each course			
	Science	Mathematics	Social Studies	English
8	2.7 (2217)	2.9 (2273)	2.7 (2224)	2.7 (2253)
10	2.7 (2072)	2.5 (2219)	2.7 (1296)	2.8 (1931)
12	2.8 (884)	2.5 (1063)	2.8 (1311)	2.8 (1494)
The standard error of the mean for each cell was .03				

Source: Jon D. Miller. 2007. "Student Interest in Science and Mathematics: Measures, Patterns, and Consequences." (The numbers in parentheses indicate sample size)

The LSAY results suggest a positive relationship between an individual's attitude toward science during high school and choice of a STEM major in college (see Table 2). The level of interest in science was assessed among students in grade 10, and their college major determined subsequently. Those expressing the highest level of interest (score: 4) were more likely to have chosen a STEM major than were students uninterested (score: 0) in science. It is worth noting that most students chose non-STEM majors, regardless of the evaluations of science they had made earlier. Attitudes alone do not shape career trajectories.

Table 2: Student Liking for Science Courses and Enrollment in a STEM Major.



Level of Science Interest	Four years after high school …		N
	Non-STEM major	STEM major	
Grade 10			
0	87%	13%	70
1	94	6	87
2	86	14	206
3	83	17	351
4	72	28	250
	Gamma = .32		

Source: Jon D. Miller. 2007. "Student Interest in Science and Mathematics: Measures, Patterns, and Consequences."

Based on our experience we believe that persistence in a STEM major is affected by:

- Bridge programs in the summer before the first year of college to enable at-risk students to gain the academic skills necessary to compete successfully at the college level;
- Changes in pedagogy and content of first-year STEM gateway courses that allow all students to master content and improve their ability to think critically and independently;
- Redesign of early mathematics sequences so that students deficient in mathematics can reach mastery levels;
- Opportunities for first- and second-year undergraduates to participate in authentic research;
- Initiatives that provide students with advice about the careers available to STEM majors, the kinds of interests and skills required in these careers, and the preparation necessary for the careers; and
- Mentoring programs involving both peer mentoring and faculty mentoring that encourage students to continue with their majors and that provide individualized guidance for navigating through these demanding STEM majors.

Teachers

NSF has invested heavily in research and development programs to improve the knowledge, skills, and performance of teachers at all levels. Initial NSF results show that others have picked up this research and have investigated at large scale such as ExxonMobil mentioned below. The investments are particularly noteworthy in reference to professional development.

Efforts to gauge the impacts of professional development have been constrained by a lack of instruments to measure teacher knowledge. Attempts to understand the relationship between teacher knowledge and student learning have been similarly limited. To address this need, the NSF's Math and Science Partnership program has funded many projects such as the examples below that have produced measures of knowledge that are being used widely.

The Assessing Teacher Learning About Science Teaching (ATLAST) project is such an example. The project developed a program on force and motion for high school teachers and a test (ATLAST) to measure teacher learning of the fundamental concepts. Subsequently, the teachers tested their ninth grade physics students before the students were taught the concepts and reassessed them following a unit of instruction. The outcome: the higher the teacher's score, the greater the change in the scores of their students. ATLAST warrants attention not only because it fosters and measures learning by teachers, but also because it relates such learning to the performance of students.

On mathematics learning, the study, Learning Mathematics for Teaching (LMT), merits notice. The study developed an instrument called Mathematical Knowledge for Teaching (MKT) to measure the mathematical knowledge and skills of teachers.

It then tested the performance of the students. The outcome revealed a positive relationship between the performance of the teacher on the MKT test and the performance of his or her students. This outcome was obtained even when the study took into account the performance of the students on prior tests and differences in the backgrounds of the teachers and their schools. The LMT study later videotaped lessons from mathematics classrooms and scored the quality of the instruction, as evident in the absence of mathematical errors, the use of mathematical justifications and explanations, and the teachers' skill in representing the work of students. The instruction judged to be of higher quality occurred among teachers with higher scores on mathematical knowledge for teaching.

The LMT study reinforces a result other research has uncovered: teaching effectiveness depends on an ability to translate knowledge into quality experiences for students. One such investigation comes from the Alliance for Improvement of Mathematics Skills, Pre-K–16, a partnership that includes Del Mar Community College, Texas A&M University–Kingsville, and nine independent school districts in South Texas. Over a two-year period, approximately 250 teachers participated in more than 30 hours of professional development, typically through mathematics-focused institutes. An observational study of teachers who participated in the institutes showed a sharp decrease in their use of "teacher-directed" instruction (lecture) in favor of a more "student-centered" learning environment. Such an environment related positively to measures of student engagement.

A project funded at the University of Miami offers possibilities for closing the gaps still found in achievement between population groups. The program provided teachers with professional development workshops, and new mathematics and science instructional materials designed for English language learners. Measures taken before and after the instruction showed changes in science achievement that reached statistical significance. Likewise, performance in mathematics, measured on a statewide mathematics test, indicated greater improvement for the students given the specialized instruction than for a comparison group. It should be noted that both groups consisted overwhelmingly of students from economically disadvantaged backgrounds.

Additional NSF programs designed to strengthen STEM teaching include Discovery Research K–12, with its emphasis on improving knowledge about teaching and learning; Geoscience Teacher Training (GEO–Teach), created to identify strategies of effective pre- and in-service preparation for Earth science teachers; and the Physics Teacher Education Coalition, a project focused on increasing the quality and numbers of teachers in physics and other physical sciences. Past investments by NSF in teacher preparation have led to new models, such as the UTeach program at the University of Texas, now being replicated with ExxonMobil support. This model gives center-stage to master K–12 teachers who take the lead in designing and teaching pre-service courses.

Tools

NSF funded research has produced materials and resources to accelerate student learning. Those materials in turn have been assessed in educational settings at various scales as noted below, to determine their viability as classroom tools. Among the tools NSF has supported are:

- *The Cognitive Tutor,* a software package that provides personalized instruction for the individual student. The development work on *The Cognitive Tutor* began in 1980 and continued into 2003 funded through more than 20 awards from programs across the Foundation. Tutors using the software are now reaching over 500,000 students in 2600 schools. Evaluations, using very rigorous designs to assess impact, have shown that the tutors do in fact improve learning. Indeed, the consistently replicated results have made *The Cognitive Tutor* one of only a few approaches the Department of Education includes in its *What Works Clearinghouse.* Importantly, the positive effects appear in rural as well as urban settings, in schools with at-risk students and more advantaged ones, and among honors students in addition to English language learners.
- *SimCalc Math World,* consists of text materials and software for computers, and calculators for teaching core algebra concepts. SimCalc has its roots in research funded by the Directorate for Computer and Information Sciences in 1980. The software development began with an award granted in 1993. In the summer of 2005, SRI International began a rigorously designed randomized controlled experiment with 151 7th and 8th grade teachers and thousands of students from all over Texas. The project compared a SimCalc replacement to existing 7th- and 8th-grade pre-algebra curricula. In both grades, the use

of the SimCalc curriculum and technology resulted in greater student learning gains, especially for advanced aspects of proportionality, rates, and linear functions that are required for further STEM learning. The findings were robust across variations in regional demographics, school poverty levels, student ethnicity and gender, and with teachers having differing attitudes, beliefs, and backgrounds.

Students of teachers who implemented SimCalc's integrated curriculum and software materials learned more advanced mathematics than did students given other instructional materials. The project's findings demonstrate how society can harness the dynamic capabilities of technology to expand access to advanced mathematics, and accelerate students' progress towards STEM careers.

- *Engineering is Elementary,* a curriculum for elementary school students, was developed by the informal science community. The curriculum integrates engineering and technology concepts and skills with elementary science topics. In addition, it has connections with reading skills, mathematics, and social studies. Studies show that children using the *Engineering is Elementary* materials gain in their understanding of engineering and science topics, compared to children not using the materials. In addition, children in the experimental group come to know what engineers do and what technology entails.

  The curriculum and the research associated with it delve into an area explored only infrequently: how children at young ages think about engineering concepts. The body of work not only illuminates this area, but also outlines ways in which teachers can draw upon the knowledge and assumptions children possess. Initial research suggests that this approach has been successful in helping young children envision themselves as engineers.

I have presented thus far projects and outcomes centered on STEM learning in formal settings. But NSF recognizes and supports work in the informal sector as well. For example, a museum-based enrichment program tracked past participants who had completed at least one year of the program between 1992 and 1997, and found that for the people pursuing careers in health and other STEM fields, mentors and exposure to job skills were key elements to their job choice. With this finding in mind, 29 Innovative Technology Experiences for Students and Teachers (ITEST) projects currently match students with mentors, and all ITEST projects offer opportunities to develop job skills that students can take with them beyond the ITEST experience. Informal Science and Education (ISE) youth projects also use this strategy to build student exposure to STEM careers.

NSF takes pride in the work that it has supported and the gains in student and teacher learning that are a result of those investments. However, there is substantially more work to be undertaken. To ensure continued progress, NSF stands ready to act in partnership with other federal agencies, such as the Department of Education, business and industry, professional associations and of course, policy-makers. The quality teaching and learning that the Nation needs—that our youth need—depend on us all.

BIOGRAPHY FOR CORA B. MARRETT

Dr. Cora B. Marrett is the Assistant Director of the Directorate for Education and Human Resources (EHR) at the National Science Foundation (NSF). She leads the NSF's mission to achieve excellence in U.S. science, technology, engineering and mathematics (STEM) education with oversight of a budget of approximately $825 million and a staff of 150. EHR is the principal source of federal support for strengthening STEM education through education research and development (R&D).

Dr. Marrett currently co-chairs the Subcommittee on science, technology, engineering and mathematics Education of the National Science and Technology Council, Committee on Science.

Prior to her appointment at the NSF, Dr. Marrett served as the Senior Vice President for Academic Affairs in the University of Wisconsin System. Her NSF position is in conjunction with the UW–Madison Department of Sociology, where she remains a tenured faculty member.

Earlier, she held the post of Senior Vice Chancellor for Academic Affairs and Provost at the University of Massachusetts–Amherst.

Her current position represents a return to NSF. She served at NSF as the first Assistant Director of the Directorate for Social, Behavioral and Economic Sciences. She received the NSF's Distinguished Service Award for her leadership in developing new research programs and articulating the scientific projects of the directorate. Dr. Marrett also served as the initial chair of the Committee on Equal Opportunities in Science and Engineering (CEOSE).

In addition to her faculty appointment at the University of Wisconsin–Madison, she has been a faculty member at the University of North Carolina and Western Michigan University.

Dr. Marrett holds a B.A. degree from Virginia Union University, and M.A. and Ph.D. degrees from UW–Madison. She has an honorary doctorate from Wake Forest University. She is a Fellow of the American Association for the Advancement of Science, the American Academy of Arts and Sciences, and Sigma Xi, the Science Research Society.

Dr. Marrett received the Erich Bloch Distinguished Service Award from the Quality Education for Minorities (QEM) Network, given annually to an individual who has made singular contributions to the advancement of science and to the participation of groups under-represented in science, technology, engineering and mathematics. She is widely published in the field of sociology, and has held a number of public and professional service positions.

Mr. HALL. At this time we'll hear from Mr. James Henry Russell. Stay as close to the five minutes as you possibly can.

STATEMENT OF MR. JAMES HENRY RUSSELL, SUPERINTENDENT OF SCHOOLS, TEXARKANA INDEPENDENT SCHOOL DISTRICT, TEXARKANA, TEXAS

Mr. RUSSELL. Yes, sir.

Ranking Member Hall, Chairman Gordon and Congressman Ross, what a privilege it is to be here today. Not only to testify, but what a privilege this whole day has been for the Texarkana Independent School District and so many of the great things we have going on here. Not just here but in this community. As Congressman Hall mentioned earlier, I have been Superintendent now for a year and my mentor and trainer for the last ten years has been Dr. Larry Sullivan.

I'll give you a warning sign of when you have great things coming in a community. About four years ago, Dr. Sullivan and Dr. Steven Hensley, President of TAMU–Texarkana, started having lunch together quite often. For the staff that works under them, that can be a scary thing because while they are great leaders and visionaries, they're also great delegators, and we knew there was quite a bit of work to come.

People keep asking how this school district appeared, and I'll tell you it is because of these two great visionary leaders, the incredible Morriss family that made such a generous donation, and an entire community that not only supported this school district along with everything else—our community demands this type of school district.

We talk about importance of STEM education and why it's important. I really enjoyed reading Bill Gates' testimony earlier talking about the two million new jobs that will be created in the future. It is our job to make sure the students of today are ready for those two million jobs that are coming in the future. STEM in our Texarkana community is really doing well. We actually started off at the high school level a few years ago. In fact, the Dean of the Engineering Program at TAMU–Texarkana, Dr. Doug Green, started teaching classes at Texas High School. The classes then moved to Morriss Elementary last August. That started last August, which you're seeing today. Then starting off this fall we will be starting with our sixth grade at a part of the academy of Texas Middle School, so it has STEM in Texas I.S.D. as well.

Motivation is how we got to this school. My favorite professor, Dr. Rosanne Stripling to my left, always taught me about motivation and that you must have the needs of the community if you're going to be successful. So, we started with a Blue Ribbon Committee several months ago and found there was definitely a need for more engineers and more mathematicians, not only in this community but in this world. So, we had that grass roots support from the start, and it wasn't hard to build and move forward.

Keeping students motivated in STEM, well I think you have just done that for us today. Among the 396 students that all of you have touched today, I guarantee you each of these kids is going home today wanting to be an astronaut or mathematician or a scientist and believing that they can be. This is so important with our students today, and we know they can do this.

One of the major problems that limit the performance of students and teachers is finding qualified science and math teachers that will come to your schools and stay in your schools is a huge issue. There are so many opportunities in the corporate world it's really hard for school districts to compete to find these master teachers, and as we all know your staff is what gets things done. Teachers that love to teach and have the passion and drive and competence in this area is, in my opinion, the key number one issue. Motivating the kids is really not hard. You just need the facilities, the teachers and the programs.

Some important things that the Federal Government has done and can do, providing a grant for another top-notch facility like this, we definitely would not turn down. We are proud to say this facility was totally built with local money, and we did not raise taxes to do it. So, there's no federal money involved here. It was a local effort, and we're proud of the facility. The Federal Government has been instrumental in different teacher training. You heard Dr. Marrett mention that.

Again, our teachers are so important in making sure that we have the top ones. It is very important. And also curriculum. The National Science Foundation supports the Museum of Science in Boston. Actually, if you walked around the school today, you would see curriculum from the Museum of Science in Boston funded through the National Science Foundation at work. We just placed a large order and we could use more and more.

We have all sorts of cooperative programs with A&M on developing curriculum. Dr. Stripling, I know, will talk about that more. Dr. David Allen who is probably in the room today, has a lot of instrumental programs that help train our teachers.

I'm going to move to my closing now and stay close to that five minutes, and I'm actually going to stray away from STEM for just a minute. Rick Sandlin is another key reason why this school has been so successful; his is a great individual and has a great staff.

I've got seven other elementary principals sitting behind me that are just having to hold onto their chairs to keep from standing up and screaming, come see what I'm doing in various other areas.

What we need is great education. What we need are passionate good leaders and passionate good teachers to show the kids that they can do absolutely anything. Give those basic skills. Align with a great college like Texas A&M University, so the kids see much farther than today. So, in closing, again, thank you so much for being here. Thank you for honoring us and our kids. Thank you for showing our kids what their future can be if they continue to work hard. I'll be happy to answer any questions. The real experts are sitting not too close behind me to whisper me the answers when I need it.

Mr. HALL. They're good to have, aren't they?

[The prepared statement of Mr. Russell follows:]

PREPARED STATEMENT OF JAMES HENRY RUSSELL

1. What is the overall state of STEM education in Texarkana?

We are excited about science, technology, engineering, and mathematics education in the Texarkana Independent School District. Our goal is to offer challenging mathematics and engineering concepts by providing a rigorous and seamless STEM curriculum.

The Martha and Josh Morriss Mathematics and Engineering Elementary School is a state-of-the-art facility that serves as a national model for how young children can become engaged and educated in mathematics and engineering.

At Texas Middle School we will provide these opportunities through our new Math, Science, and Engineering Academy. This academy, designed for sixth grade students, is a model that will be extended to seventh and eighth grades during the next two years.

Students at Texas High School may earn both high school and college credits in a myriad of courses, including 38 semester credit hours in math, science, and engineering.

The following value-added elements are included in our STEM program:

- Engineering Encounters/Academy Showcases—cross grade level, theme-based authentic assessment projects completed and presented by students to the public;
- An engaging engineering curriculum supported by the National Center for Technological Literacy and the Museum of Science, Boston;
- A math curriculum in which the K–8th grade and Algebra I Texas Essential Knowledge and Skills (TEKS) are accelerated;
- Dual credit courses, including advanced mathematics, science, and engineering;
- Extended school-year enrichment activities, such as a two-week summer Circuitry Camp and after-school Robotics.

Why is it important for all students to achieve proficiency in these subjects?

In an increasingly technological society, it is imperative for students to achieve proficiency in science, technology, engineering, and mathematics. Student proficiency is necessary to close the gap between participation and success in secondary and higher education in a manner that effectively addresses a growing professional and career demand. As Bill Gates recently testified before the House Committee on Science and Technology, statistics project two million job openings in science, technology, engineering, and mathematics-related fields by 2014. The decline in students pursuing STEM-related careers could stifle innovation and economic growth. In the words of the STEM Education Coalition, "We believe that excellence in STEM education at all levels, among all populations, is vital to our nation's long-term economic prosperity, global competitiveness, and homeland security."

2. What was the motivation behind establishing the Martha and Josh Morriss Mathematics and Engineering Elementary School?

A growing gap between the supply and demand for professionals in engineering and mathematics careers has alerted stakeholders across the Nation. At the national level, resolution of this dilemma has been identified as a federal priority via appropriation of the Science, Technology, Engineering, and Mathematics (STEM) project and the American Competitiveness Initiative unveiled by President Bush in his January 2006 State of the Union Address. Texas Senator Kay Bailey Hutchison publicly recognized the growing need for engineering education and research in Texas when she announced the creation of the Texas Academy of Science, Engineering, and Medicine in San Antonio in January 2004. The regional need for more engineers was documented in the late 1990s when Texarkana area businesses (e.g., International Paper, Domtar Paper Mill, and Alcoa) identified the need for an engineering program at Texas A&M–Texarkana as the number one community priority. The need for more regionally available engineers, coupled with the need for an increase in the quantity and quality of United States grown and educated engineers, sparked the development of the Texas A&M University–Texarkana—Texarkana ISD K–16 Engineering Collaborative.

Although the effectiveness of a K–16 engineering collaborative as a means of ameliorating the supply and demand gap of engineers is a very logical, research-based approach, a comprehensive search has not identified another partnership of this kind across the United States. The Texas A&M University–Texarkana—Texarkana ISD K–16 Engineering Collaborative is a unique, sustainable, and replicable model that sets a gold standard for public schools and universities.

What role did parents, the community and local businesses play in the establishment of this school?

In January 2005, Texarkana ISD convened the first meeting of the Blue Ribbon Committee, a group of parents, community and business leaders, and school district representatives. This panel's purpose was to review the school district's facilities, finances, and curriculum, and to make recommendations concerning future plans for the district. Following a series of planning sessions, the committee recommended the establishment of a new elementary school, a school that would become a national model for K–16 collaboration in how young children can become engaged in and educated for careers in mathematics and engineering.

The first concrete step to this concept becoming a reality occurred in spring 2006 when the Josh Morriss, Jr. family donated 10.6 acres of land near the new 375 acre Texas A&M–Texarkana campus site for the new elementary school.

Along with the contributions of the Blue Ribbon Committee and the Josh Morriss, Jr. family, Texas A&M University–Texarkana became an integral partner in the school's development. The University's involvement included consultation in the floor plan and architectural design, in integrated curriculum development, and in professional development for teachers.

Is there a plan in place to keep these students motivated in STEM subjects as they make the transition to middle school and on to high school?

Texas A&M University–Texarkana and Texarkana Independent School District have established a vertically aligned kindergarten–16 engineering education collaborative that will be executed at four levels:

1) A K–5 public elementary school (Martha and Josh Morriss Mathematics and Engineering Elementary School) that provides a mathematics and pre-engineering integrated curriculum, Engineering Encounters (student-led, hands-on experiences shared with parents and the community), and pre-engineering thematic units (i.e., structures, forces, and gears) at each grade level (opened in fall 2007)
2) The Math, Science, and Engineering Academy, a pre-engineering school-within-a-school at Texas Middle School (planned for fall 2008)
3) Selected mathematics and science courses with pre-engineering content enrichment and dual credit engineering courses at Texas High School (fall 2006)
4) A choice of three engineering related programs of study at Texas A&M–Texarkana: BS in Computer and Information Sciences (fall 2005), BS in Electrical Engineering (planned for fall 2008), and BS in Mechanical Engineering (planned for fall 2010).

3. What are the major problems that limit the performance of students and teachers, and what do you feel is the single, most important step that the Federal Government should take to improve K–12th grade math and science education?

The major problems that limit the performance of students and teachers in STEM education are centered around the lack of educational focus on STEM. Traditionally, teacher training in STEM has been limited; therefore, teachers often do not have confidence in their own STEM background knowledge and skills. This limitation leads to a deficiency in student awareness and interest in STEM career fields. In addition, instructional resources for STEM courses are costly, and funding is minimal. Finally, very few, if any, national models of successful, aligned STEM programs exist.

The most important step the Federal Government should take to improve K–12th grade math and science education is to provide strong support for STEM teacher professional development. Research consistently shows that the single most important factor in student achievement is teacher quality. We urge the Federal Government to provide grants and other financial assistance directly to school districts and to other public educational entities that have identified needs and priorities in the area of STEM education.

What involvement have you had with math and science education programs at the National Science Foundation or other federal agencies as well as those in the State of Texas?

The Texarkana Independent School District has been involved with the following STEM programs:

- **East Texas Regional Collaborative for Excellence in Science Teaching—**a continuing project funded since 1997; offered through grants from the Texas Regional Collaboratives for Excellence in Science Teaching
- **Teacher-to-Teacher Initiative—**designed by teachers for teachers in order to provide technical support, professional development opportunities, and recognition for teachers of all content areas and grade levels; offered through the U.S. Department of Education
- **The East Texas STEM Center—**a federal program designed to improve instruction and academic performance in science- and math-related subjects at Texas high schools; offered through a T–STEM federal grant
- **The Teacher Quality Grants Program—**a federally funded effort providing grants to higher education institutions and nonprofit organizations; offered through the Texas Higher Education Coordinating Board and the Charles A. Dana Center

What are the most important and effective components of these programs?

These programs focus on sustained professional development in both STEM content and in research-based instructional strategies for teachers. All three programs rely on federal and State funding to provide opportunities for professional development. The programs provide crucial support for teachers in preparing students for college and for entry into STEM career fields.

Engineering Curriculum

Grades	1st 6 Weeks	2nd 6 Weeks	3rd 6 Weeks	4th 6 Weeks	5th 6 Weeks	6th 6 Weeks
	Environmental Engineering	Civil Engineering	Earth and Space Engineering	Bioengineering	Electrical and Mechanical Engineering	Manufacturing Engineering
K	What is an Engineer? The Engineering Process: DSM III Investigating Water	*Tunnels*	Wind: EIE: Catching the Wind Designing Windmills	*Engineering Animal Parts*	Magnets Permanent Magnet Activity Kit and Idea Factory	Houses: Lincoln Logs and Legos
1	*What is an Engineer? The Engineering Process Rube Goldberg*	Walls: EIE: A Sticky Situation:The Great Wall of China	Solids and Liquids: EIE: A Work in Process	*Animals as Engineers*	Sink or Float: DSM III Sink or Float	A Chair for Little Bear (Lego Education)
2	What is an Engineer? The Engineering Process DSMIII Forces and Motion	*Pyramids*	Weather: DSM III Weather Instruments	Insects and Plants EIE: The Best of Bugs: Designing Hand Pollinators	Magnetism and Transportation: EIE The Attraction is Obvious	Transportation Vehicles (Boats, Cars, Airplanes)
3	What is an Engineer? The Engineering ProcessThe Design Process EIE: Thinking Inside the Box: Designing a Plant Package	*Towers*	Balloons, Parachutes and Airplanes: DSM II Amazing Air	Organisms: EIE: Just Passing Through Designing Membranes	Energy Transfer, Conduction, and Circuitry: EIE: An Alarming Idea	*Domes and Arches*
4	What is an Engineer? The Engineering Process: EIE:Water, Water Everywhere Designing Water Filters	*Teach Engineering: Parking Garage*	Rockets	The Physics of Sound: EIE: Sounds Like Fun	Energy: Amusement Park	Exploring Force and Motion: EIE: Marvelous Machines
5	What is an Engineer? The Engineering Process Water Purification DSM II Solar Energy	Geotechnical Engineering EIE: A Stick in the Mud	Telescopes	*Prosthetics*	Forces: Roller Coaster	Balances and Forces: EIE: Get To The Other Side: Designing Bridges and KNEX Bridges

BIOGRAPHY FOR JAMES HENRY RUSSELL

EDUCATION

- Superintendent Certification, Summer 2005
- Principal Certification. anticipated December 2004
- Masters in Education Administration, anticipated December 2004–Texas A&M University, Texarkana
- Certified Public Account (CPA) Certification, 1994
- BBA in Accounting, 1992–Texas A&M University, College Station, Texas

EMPLOYMENT

Texarkana Independent School District, 4241 Summerhill Road, Texarkana, TX; 903.794.3651

Texarkana ISD is an urban school district located on the Texas–Arkansas border. The District has seven elementary campuses, one middle school, and one high school with a combined student enrollment of approximately 6,000 students, served by over 800 employees.

Formaily Named Superintendent of Schools August 14, 2007. Mr. Russell is a lifelong resident of Texarkana, an honor graduate of Texas High School with a Bachelor's degree in accounting and a Master's in Education Administration from Texas A&M University. He is a Certified Public Accountant with Principal and Superintendent Certifications. He began his career with TISD in August 1994 as Food Services Comptroller. A year later, he moved into the position of Director of Purchasing for three years, following by Directors of Purchasing & Support Services where he remained until 2003 when he was named Assistant Superintendent for Business & Support Services. He was named Deputy Superintendent in October 2006.

Assistant Superintendent for Business and Support Operations—(May 2003 to October 2006)

- Generate and manage an annual budget in excess of $40 million
- Manage all financial resources of the school district, including cash flow and investment system, debt financing
- Supervise all business and support operations with the following departments: Purchasing, Accounting, Technology, Transportation, Maintenance, Security/Police, Management Information Systems (MIS). Food Service, and Security/Police—consisting of over 400 employees
- Direct all district construction projects, including current additions and improvements to Texas High School ($13 million)
- Serve on the Superintendent's Cabinet in an advisory role for all district operations and long-range planning

Director of Purchasing and Support Operations—(February 1998 to May 2003)

- Supervised Maintenance, Transportation, Food Service, Security, Custodial and Grounds Departments
- Managed the district warehouse inventory system and central warehouse operation
- Oversaw $30 million in construction projects including the new Texas Middle School ($25 million) and improvements and additions to seven elementary campuses ($9 million)
- Participated in the development, implementation and management of a health benefit trust and partially self-insured health plan
- Developed a profit-oriented venture with other school districts to operate their food service division

Director of Purchasing and Food Service Comptroller—(December 1994 to February 1998)

- Supervised the Food Service department
- Developed district purchasing guide
- Responsible for all district purchasing activities
- Automated warehouse inventory system
- Negotiated with vendors for cost savings and efficiency

Food Service Comptroller—(August 1994 to December 1994)

- Implemented district-wide point-of-sale system
- Instituted computerized inventory system
- Generated monthly financial statements by campus
- Developed accounting control system

Thomas & Thomas, Certified Public Accounts and Regional Accounting Firm

Staff Accountant—(June 1992 to August 1994)

- Conducted audits for corporations and for-profit and non-profit organizations
- Prepared corporate and personal tax returns
- Consulted with businesses on financial efficiency and tax laws

CIVIC AND PROFESSIONAL, ORGANIZATIONS

CURRENT

Texarkana Chamber of Commerce—President Elect
Texarkana Chamber of Commerce—Board of Directors Member
Texarkana Community Foundation—Youth Advisory Council Adult Sponsor
Texas Association of Public Schools—Board Member
Williams Memorial Methodist Church—Chairman, Board of Trustees and Member, Building

Committee and Finance Committee
Leadership Texarkana—Board of Directors Member
American Institute of Certified Public Accounts—Member
Texas Society of Certified Public Accounts—Member

FORMER

Oaklawn Rotary Club—President
Greater United Way of Texarkana—Chairman
Awareness of Crime—Board Member
United Way of Texarkana—Executive Board Member
Texarkana Junior League—Advisory Board Member
Today's Youth, Tomorrow's Leaders—Curriculum Chairman, two years
Texarkana Volunteer Center—Board Member
American Heartwalk and Relay for Life—Logistics Chairman
Susan G. Komen Texarkana Race for the Cure—Volunteer
Leadership Texarkana—Graduate
Girl Scouts of Conifer Council—Advisory Board Member

COLLEGE ORGANIZATIONS

Beta Gamma Sigma—Business Administration Honor Society
Beta Alpha Psi—National Accounting Honor Fraternity
Accounting Society

PERSONAL INFORMATION

Mr. Russell is married to Rosemary Reed Russell, and they are active members of Williams Memorial United Methodist Church. Mrs. Russell is also a teacher in Texarkana ISD. They have three children—Madeline–12, Colleen–9, and Reed–6.

Mr. HALL. Okay, before I ask Rosanne Stripling to begin, let me recognize others that had a part in bringing this day to fruition. Our mayor Dr.—Mayor Brown, stand up please and let us recognize you. Thank you. He was here. How about our new mayor, Steve Mayo?

VOICE. They're out working.

Mr. HALL. They're out there cutting taxes and filling potholes, Right. All right, Rosanne Stripling, you're going to have to give us in five minutes a good reference as to where these two gentlemen are and what they're doing.

Dr. STRIPLING. That I can't do.

Mr. HALL. Let me recognize you. Before we do, let me recognize Steven R. Hensley, too, who is our President of Texas A&M. Where are you, Mr. President?

STATEMENT OF DR. ROSANNE STRIPLING, PROVOST AND VICE PRESIDENT FOR ACADEMIC AFFAIRS, TEXAS A&M UNIVERSITY–TEXARKANA, TEXARKANA, TEXAS

Dr. STRIPLING. Chairman Gordon, Ranking Member Hall, Congressman Ross. It is indeed a pleasure and an honor to be here this afternoon to engage in this very important conversation, and specifically to share with all of you some ways in which universities can actually work with communities and their public schools to partner—to effectively partner in achieving the stated goal of this hearing.

One of the components of the Texas A&M University Texarkana Institutional mission is service to the Northeast Texas region. The preparation of teachers for area schools was one of the very first manifestations of this commitment and continues to be a major emphasis today.

During the past ten to fifteen years, partnerships have grown to include new programs and initiatives as well as the expansion of existing programs to new size. Several examples, including those relating to STEM, are described in my written testimony which I know you have a copy of.

One of the most notable partnerships, however, is the regional and national award winning Westlawn Professional Development School, a collaborative effort between Texarkana I.S.D. and A&M–Texarkana that have purchased professional, educated preparation from a very unique, research-based medical model design. Success of the Westlawn PDS set the stage for the university's next major collaborative with the Texarkana I.S.D., the Martha and Josh Morriss Elementary School for Mathematics and Engineering.

The three main categories of collaboration between the university and the I.S.D. were No. 1, facility planning; No. 2, integrated curriculum development, and No. 3, teacher training. Let me briefly describe our collaborative efforts in each of these areas.

A&M–Texarkana engineering faculty work with Texarkana I.S.D. administrators and their architects in the conceptual design of the building providing consultants, consultation regarding the size, proximity and utilization of space, as well as the inclusion of engineering and mathematics value-added elements.

Faculty and administration within the College of Arts and Science and Education worked collaboratively with representatives from the Texarkana I.S.D. curriculum department to envision and create a frame work for the new school's K–5 curriculum. After much research and discussion the team determined that the State core curriculum would be expanded to include discreet engineering courses at each grade level and delivered via an integrated approach to engineering or mathematics to ensure that those concepts would be threaded throughout all of the other subjects the students were taking.

Delivery of curriculum would be student-centered and project based, with assessment of student mastery of the curriculum being heavily dependent upon authentic performance measures. Now, after the integrated curriculum is outlined, the Texarkana I.S.D. curriculum specialist and the A&M–Texarkana faculty developed syllabi for two university graduate courses that would be taken by all Morriss teachers during the summer prior to the opening of the new school. One course addressed the design or the content of the curriculum. The second course addressed the delivery or the instructional strategies of the integrated curriculum. Both courses were taught by Texarkana I.S.D. curriculum specialists who were given adjunct faculty status at the university.

Morriss teachers receive credit for both courses toward their Master of Science degrees in curriculum instruction, one of two requirements of all Morriss teachers who didn't possess a Master's degree at the time of their assignment to the school.

The other requirement is attainment of the Texas Master Mathematics Teacher's certificate, a twelve-semester credit hour program developed initially by A&M faculty for training of Morriss teachers.

When fall of 2007 arrived there was really no question in anybody's mind that the foundation for success was in place, but we also knew that the implementation phase of the project is always the most challenging, and that to declare and not deliver would be worse than never declaring at all.

After what we've seen today at this extraordinary school, is there any doubt in anybody's mind that shaping our future science, technology, engineering, and mathematics leaders of tomorrow can't be successfully accomplished through the delivery of a rigorous curriculum in the primary grades that initiates and sustains the engagement, curiosity and excitement of young children in science and of mathematics.

In closing, there is nothing profound or complex about this replicable model. It's the result of a gestalt of cooperation, vision, tenacity, and courage, the courage to do what we know is required to offer our children the chance to compete and lead in tomorrow's world. Thank you.

Mr. HALL. I'm going to master this thing before everybody leaves. We'll recognize Mr. Mike Leherr for five minutes.

Thank you, Dr. Stripling.

[The prepared statement of Dr. Stripling follows:]

PREPARED STATEMENT OF ROSANNE STRIPLING

Texas A&M University–Texarkana has had a long tradition of partnering with area public schools. One of the components of our institutional mission is service to the Northeast Texas region. The preparation of teachers for area public schools was one of the first manifestations of this commitment and continues to be a major emphasis. During the past ten to fifteen years, partnerships have grown to include new programs and initiatives, as well as the expansion of existing programs at new sites. Noteworthy examples include:

- *The A&M-Texarkana Center on the Northeast Texas Community College (NTCC) in Mt. Pleasant that provides upper division course work for NTCC students who want to complete their undergraduate degree and teacher certification program in selected areas.* The NTCC Center, in its fifth year, offers students to opportunity to pursue a teaching certificate in EC–4, EC–4 with special education, 4–8 mathematics, and high school mathematics. The available options have broadened to include additional teaching certificates in biology and a degree in criminal justice. As a community college, NTCC's mission focuses on serving graduates of local high schools as well as citizens who live in the Northeast Texas geographical area.

- *"Preparing Educators of Tomorrow" (PET), an aide-to-teacher program at Hallsville:* The College of Arts and Sciences and Education developed a partnership with Kilgore Community College and public school systems in the Longview–Hallsville area for the purpose of assisting school districts to "grow their own" teachers. The first cohort that graduated in 2007achieved a 100 percent passing rate on the State certification examination (TExES), and the second cohort is on schedule to graduate in summer 2008. The Hallsville ISD has been a major partner in this effort, as evidenced by the district leadership's willingness to provide classroom meeting space and equipment for instruction.
- *Expansion of the master of education degree in education leadership and principal certification program to teachers in the Hallsville and Hughes Springs areas, via a Web-enhanced format:* In the fall of 2007, A&M–Texarkana expanded the existing Hallsville partnership by adding a distance education program in which educators at areas schools can attain a Master's degree in education administration and principal certification via a Web-enhanced format involving face-to-face seminar and on-line components. The purpose of this program is to increase the supply of quality principals for area schools. The Hughes Springs and Hallsville ISDs provide classroom space without cost to the University. During spring 2008, 32 students are enrolled in both programs.
- *Westlawn Elementary Professional Development School (PDS), a Texarkana Independent School District (ISD) elementary school where A&M–Texarkana student teachers (teacher interns employed by the district) work with master teachers (mentors) in a clinical instructional setting during the fall and spring semesters of the students' senior year.* Two interns and a master teacher at each grade level (K–5) are assigned to teach approximately 45 students in a team teaching approach. An A&M–Texarkana faculty member is assigned to the PDS as a university liaison on a full-time basis for demonstration teaching, delivery of integrated instruction of the university pedagogy courses that the teacher interns are taking during their last two semesters, and overall program supervision and management. The Westlawn PDS won the *Magna Award for Teaching Excellence* from the National Association of School Boards and the *Innovation in Teacher Education Award* from the Southeastern Regional Association of Teacher Educators in 2005.
- *Dual credit introductory engineering courses on the Texas High School campus:* A&M–Texarkana engineering faculty have taught dual credit introductory engineering courses on the Texas High School campus in the Texarkana ISD each semester for the past two school years.
- *Instructional improvement consultant service to select Texarkana ISD schools:* During the 2003–04 academic year, an A&M–Texarkana faculty member served as the Technical Assistance Provider (TAP) to Dunbar Intermediate School, a low performing Texarkana ISD elementary school to provide consultant assistance and teacher professional development. After the selection and implementation of a clinical reading program, the campus attained and as continued to maintain "Recognized" status from the Texas Education Agency. The same clinical instruction was expanded to the feeder early literacy campus, Theron Jones, the following year with the same exceptional academic results.
- *The Master of Science degree in curriculum and instruction that provides sufficient flexibility for surrounding school districts to tailor the graduate study of teachers to meet district needs:* The 36 semester credit hour degree program includes an 18 hour curriculum core and 18 hours from one to two areas of concentration agreed upon by the student and advisor. By design, the degree is flexible enough to allow local area high school teachers to acquire the 18 hours of content within a Master's degree that are required to teach dual credit courses. Texarkana ISD began immediately to scholarship approximately 20 of their teachers through the program each year. Liberty-Eylau ISD followed quickly with up to five scholarships per year. The two districts also pay for the students' textbooks.
- *The Young Writers' Program, a program that has offered thousands of area students the opportunity to participate in a two-week, half-day writing activity each summer.* Approximately 150 students in grades two through twelve who are recommended by their classroom teachers and selected by a university

committee participate each year. Program goals are: (1) to identify students who show potential in writing and encourage them to excel as writers, (2) to create a community of writers and offer students the chance to work with professional authors, (3) to provide students with the opportunity to meet students from other schools who are interested in writing, and (4) to provide students with the opportunity to get their work published. Students have the opportunity to write in various genres, including fiction, nonfiction, and poetry. On the final day of the program, parents and other guests attend a program featuring some of the works written over the two-week period. Approximately 300 people usually attend. An anthology of the students' work is then prepared, printed, and distributed to students during the following school year.

- *Region VIII Education Service Center partnership in which A&M–Texarkana faculty work collaboratively with ESC personnel to train and certify elementary bilingual teachers for area schools:* In the past five to six years, the percentage of limited English proficient (LEP) students in the Mt. Pleasant area has grown significantly, and the need for bilingual teachers has grown accordingly. To address this need, A&M–Texarkana faculty developed and implemented a EC–4 Generalist with Bilingual Education certification program. Faculty offer course work to students via face-to-face and distance education formats. Participants spend from two to four weeks at a partner institution in Mexico each May refining their Spanish language skills.

For the past ten years, the Texarkana ISD has been A&M–Texarkana's major public school partner. Consequently, when the Texarkana ISD Board of Trustees approved the Martha and Josh Morriss Elementary School for Mathematics and Engineering in 2004, the university faculty and administration made an immediate commitment to assist the district with this formidable project. The three main categories of collaboration were facility planning, integrated curriculum development, and teacher training.

- *Facility planning:* A&M–Texarkana engineering faculty worked with Texarkana ISD administrators and their architects in the conceptual design of the building, providing consultation regarding the size, proximity, and utilization of space, as well as the inclusion of engineering and mathematics "value added" elements.
- *Integrated curriculum development:* Faculty and administration within the College of Arts & Sciences and Education worked collaboratively with representatives from the Texarkana ISD curriculum department to envision and create a framework for the new school's grade K–5 curriculum. After much research and discussion, the team determined that the Texas curriculum standards (Texas Essential Knowledge and Skills) would serve as the core curriculum, augmented by discrete engineering courses at each grade level, and delivered via an *integrated* approach in which engineering and/or mathematics concepts would be threaded through all subjects. Delivery of the curriculum would be student-centered and project-based, with assessment of student learning relying heavily upon authentic performance measures.
- *Teacher training:* After the integrated curriculum was outlined, Texarkana ISD curriculum specialists and A&M–Texarkana faculty developed syllabi for two A&M–Texarkana graduate courses that would be taken by all Morriss teachers during the summer prior to the opening of the new school. One course addressed the *design* (content) of the curriculum; the other addressed the *delivery* (instructional strategies) of the integrated curriculum. Both courses were taught by Texarkana ISD curriculum specialists who were given adjunct faculty status at the university. Morriss teachers received credit for both courses toward their Master of Science degrees in curriculum and instruction. All Morriss teachers who do not already have a Master's degree at the time of assignment to the school are required to obtain the degree, as well as the Texas Master Mathematics Teacher (MMT) certification, a 12-semester credit hour program developed by A&M–Texarkana faculty.

In addition to being a partner in the Martha and Josh Morriss Elementary School for Mathematics and Engineering, A&M–Texarkana is involved in other STEM activities:

- *East Texas Regional Collaborative for Excellence in Science Teaching (http://www.tamut.edu/-allard/etrc/etrcindex.htm):* This program involves A&M–Texarkana, Texarkana College, and pre-K–12 public school teachers in the Northeast Texas geographical area. The primary focus is on the improvement of science teaching with respect to teacher content knowledge, pedagogy, and technology integration in the classroom. Teachers receive a minimum of 105 hours of intensive professional development per year. Other agencies or institutions that have provided teacher development grants include the Texas Higher Education Coordinating Board (Teacher Quality grant program); the Texas Commission on Environmental Quality, the Institute for Global Environmental Studies ESSEA program, and the NASA–NOVA program.

- *Robotics Summer Camp for students held on the A&M–Texarkana campus each summer:* For the past three years, A&M–Texarkana's Student Recruitment Group has received funds from the Texas Workforce Commission to support the Robotics Camp, designed to encourage high school and middle school students to consider computer 8s information sciences (CIS) as a college major. Instructors for the camp are drawn from A&M–Texarkana's CIS professors and students. Attendees meet from 1 p.m. to 5 p.m. every afternoon for two weeks to learn the fundamentals of robotics, robotics programming, robotics construction techniques, and robotics trouble shooting. Camp attendance has grown steadily over the past three years. In summer 2007, 24 students participated in the Camp. There is typically a rich mix of minority students among the attendees. At the end of the Camp, teams of attendees participate in a robotics competition that receives regional news coverage.
- *Teachers' Robotics Workshop for pre-K–12 teachers:* A&M–Texarkana's computer and information sciences (CIS) program has sponsored three workshops to demonstrate how robots can be used as a teaching tool in pre-K–12 classrooms. Robotics instruction and demonstrations are provided by professional robotics instructors. Participating teachers are given access to robotics kits throughout the year to enhance their knowledge about the techniques presented in the workshop. Previous workshops have been one day in duration and each has attracted approximately 12 teachers. In summer 2008, the Teachers Robotics Workshop will be expanded to two days.
- *A Saturday Programming Clinic to teach and refine to teach and refine computer programming language skills of the participants.* A&M–Texarkana computer and information sciences faculty initiated and operate the clinic meets on A&M–Texarkana's campus each Saturday from 10 a.m. to 2 p.m. To date, the clinic has served community college students and members of the general public totaling approximately 25 participants. Next year, the clinic plans to actively recruit high school students.
- *A "think tank" collaborative to develop replicable models that can aggressively improve the success of public school children in all aspect of STEM:* For the past two years, select members of the A&M–Texarkana faculty, the Texarkana ISD leadership and curriculum staff, and City of Texarkana leadership have collaborated with faculty from UT–Dallas, Baylor University, Princeton University, and Texas State Technical Institute in the analysis and selection of next step initiatives to further the STEM agenda, utilizing the Texarkana collaboration as a laboratory model.
- *National Science Foundation (NSF) Robert Noyce Scholarship Program:* Almost four years ago, A&M–Texarkana was one of 17 universities awarded a first time Robert Noyce Scholarship Program funded by the National Science Foundation in the amount of $389,850 for four years. The purpose of the Noyce Program is to provide scholarship assistance to talented junior and senior mathematics and science undergraduate majors who demonstrate financial need and who desire to earn their teacher certification through the Bachelor's degree. STEM professionals, who have a mathematics or science degree and have been working in their field, may choose to enter A&M–Texarkana's Alternative Certification Program (ACP) to earn their teaching credentials and receive stipends through the Noyce Program. Recruitment is specifically aimed at under-represented racial minority and female students. The Noyce Program has awarded 28 scholarships to date. Twenty-nine (29) percent of the recipients are science majors and 71 percent are mathematics majors. Seventeen (17) undergraduate students have graduated and are fully certified mathematics or science teachers while four STEM professionals have received their teaching credentials for mathematics or science. Two additional students will complete resident teaching in May and will graduate in spring 2008, bringing the total number of graduates to 23. The most effective component of this program is the scholarship awards.

All of the initiatives described above, as well as those underway in other collaboratives across the Nation, are certainly worthy efforts in attempting to address the important mission so eloquently stated in the title of this hearing—*Shap-*

ing Our Future Science, Technology, Engineering and Mathematics Leaders of Tomorrow By Inspiring Our Children of Today. However, much more is needed. . .. Although the United States may be a world economic and political power in many aspects, data support a widely held concern that our students are not leading the way in science, technology, mathematics and engineering. I propose that this lack of achievement is primarily a function of what happens in schools, not limitations inherent within the students. Research supports the proposition that students from all demographic groups learn at higher rates when the curriculum objectives are clear and measurable, effective teaching methods are utilized, and formative and summative assessment data are routinely translated into feedback for instructional improvement. A final requirement is that all major stakeholders have and communicate high expectations that all students can learn the objectives at a high degree of mastery.

In the areas of mathematics and science, achieving this lofty goal involves the delivery of a rigorous curriculum in the *primary* grades via pedagogy that initiates and sustains the engagement, curiosity, and excitement of children—i.e., student-centered activities; meaningful, real-world applications; discovery learning; and challenging projects. It is critical that students develop a strong sense of confidence in their ability to "do" mathematics and science at an early age. This self-confidence promotes the further pursuit of rigorous course work in the middle and high school years that forms the foundation for a strong internal locus of control regarding their ability to choose and experience success in challenging careers in mathematics or science. Reversing a student's negative attitude toward and failure to thrive in science or mathematics that has developed in elementary school is extremely difficult to accomplish during the middle years and almost impossible by the time a student arrives on the high school campus.

Elementary teachers charged with this incredibly challenging but important task of hooking children to mathematics and science in the elementary years are, for the most part, doing their best, considering their limited formal training. Many teachers lack the content knowledge themselves and the pedagogy skills to make mathematics and science come alive for students and, therefore, to promote high levels of student curriculum mastery. A review of elementary teachers' college transcripts as well as university teacher certification plans typically reveals few mathematics/mathematic education and science/science education courses. Further, many elementary teachers self report a lack of interest, preparation, or confidence in their ability to teach mathematics or science.

The first step to improved student achievement in mathematics and science is building the capacity of teachers by increasing their content knowledge and broadening their skill sets in delivering a rigorous, but compelling and engaging curriculum. Although important at all grade levels, an urgency must be placed at the elementary level because of the greater teacher need, exacerbated by the criticality of making the student mathematics and science "connection" in the early, impressionable years. The solution to accomplishing this goal involves several approaches, ideally implemented simultaneously:

a. Redefine teacher education to require additional science and mathematics content and pedagogy course work;

b. Strengthen the knowledge and skills of existing teachers through professional development via summer institutes, specific topic seminars, graduate degree and certificate programs (such as the MMT), and professional learning communities;

c. Refine and expand the knowledge base of "what works" in mathematics and science education through applied and action research. Disseminate the results far and wide;

d. Increase the number of mathematics and science teachers by awarding four-year comprehensive scholarships to highly ranked teacher education institutions;

e. Require an aligned delivery system at the high school and university level that has a proven high probability of producing teachers prepared to teach the advanced academic courses necessary for students to compete in a world economy. Random delivery of a non-aligned curriculum at university level will continue to produce teachers that are often ill prepared to deliver the richness of advanced mathematics, science, and engineering curriculum to our youth.

The Federal Government can certainly help to actualize these efforts by establishing expectations and continuing to offer competitive funding opportunities to increase the effectiveness (knowledge and skills) of new and existing teachers.

If we are to attract, educate, and retain the critical mass of talent necessary to keep the State of Texas and the country as a whole at the forefront of research, development and ground-breaking advances in science and technology, we must take decisive steps toward that end. In addition to those already cited, the following initiatives should be considered:

a. Increase the number of doctoral/post-doctoral fellowships to promote increased numbers of terminal degree prepared university faculty to support larger and/or additional university undergraduate and Master's level programs, increasing the probability that all students who meet entrance requirements and have the desire to pursue a degree in science, mathematics, technology, and/or engineering can do so;
b. Increase the number and dollar amount of funded research grants and undergraduate, as well as graduate university scholarships in critical mathematics, engineering, and science fields;
c. Develop and implement strong information, advising, and marketing programs for science, mathematics, technology, and engineering careers in middle and high schools, targeting females and racial minority students; and
d. Enlarge the pipeline of students who are prepared to enter college and graduate with a degree in science, mathematics by increasing the number of students who pass Advanced Placement (AP) and International Baccalaureate (IB) science and mathematics courses.

From the National Academies of Science and Engineering:

a. Provide a federal tax credit to encourage employers to make continuing education available to practicing scientists and engineers;
b. Improve the visa processing for international students and scholars (Complying with the 18-month limit regarding labor certification is difficult in higher education); and
c. Provide a one-year automatic visa extension to international students who receive doctorates in science, engineering, technology, and mathematics to remain in the United States to seek employment.

The need for a working understanding of mathematics, science, and technology goes well beyond applying it in a career and shoring-up the workforce. Such knowledge and skills actually serve as tools for increasing productivity and enjoyment in everyday life, including but not limited to managing/operating a residence, participating in leisure activities and hobbies, traveling, volunteering, and maximizing entertainment options. Further, as the environment in which we live becomes increasingly complex as a result of a variety of human-induced conditions and natural phenomena, increased knowledge in, and application of, science, mathematics, and/or technology will be necessary for citizens to understand and respond quickly to changes that can significantly affect their short-term and long-range quality of life.

Providing sufficient opportunities that allow students, researchers, educators, and employees to become and then remain current and competitive in science, mathematics, and technology is critical to living, working, and prospering in a rapidly evolving world. The first step to achieving this goal is to heighten stakeholder awareness of the importance and benefits of becoming and remaining current and competitive, followed closely by establishing reasonable but high expectations and measures of accountability; offering incentives (i.e., recognition; financial rewards and/or other benefits) as well as opportunities for career advancement; and providing access to free and reasonably priced quality training and professional development.

In closing, I believe that what we have seen here today at the Martha and Josh Morriss Elementary School for Mathematics and Engineering is the result of open, collaborative efforts between and among a community willing to seek excellence, a university whose leadership embraced the wishes of the community, and a public school that was willing to take a risk to do what was needed as opposed to what has always been done. There is nothing profound or complex in this replicable model. It is the result of an integration of vision, tenacity, and the courage to do what is required to offer our children the chance to compete and lead in tomorrow's world.

STATEMENT OF MR. MIKE LEHERR, PLANT MANAGER, ALCOA–TEXARKANA, TEXARKANA, TEXAS

Mr. LEHERR. I'm privileged to be here, Chairman Gordon, Ranking Member Congressman Hall, Congressman Ross and Members of the Committee. I appreciate this opportunity to present testimony. I'm Mike Leherr, Plant Manager of Alcoa Texarkana. Alcoa–Texarkana is a manufacturer of aluminum sheet. It's about a million square feet of highly sophisticated equipment, with 350 employees. Alcoa produces aluminum for applications such as commercial trucks, trailers, boats, appliances, and general industrial applications. We supply customers throughout North America. Our workforce is made up of engineers, technicians, chemists, computer scientists, accountants, operators, and maintenance crafts. Approximately fifty percent of our salary workforce has professional technical degrees in the disciplines of science, technology, engineering and math. Additionally, many of our purchased services and products require technical training as well.

As a business leader, I am responsible for insuring Alcoa remains competitive in today's rural environment. In fact, Alcoa–Texarkana directly competes all over the world. We are facing increased competition from foreign manufacturers with significantly lower wages. In order to remain competitive now and into the future, the workforce at Alcoa must continue to find ways to apply new knowledge, develop new technologies, and implement next generation manufacturing practices. The foundation starts with strong STEM education.

Alcoa–Texarkana as well as other manufacturers in the area have increasingly found it more difficult to find and recruit highly skilled people with strong backgrounds in science, engineering and math.

We find ourselves casting a wider and wider net to find highly skilled recruits. Additionally, we are seeing an increasing number of requests for non-U.S. citizens with each professional posting. In fact, in our last engineering position, 34 percent of the applicants were educated outside of the United States. Twenty-five percent of the applicants were requesting visa sponsorship. Zero percent of the applicants were local.

It is evident that the local and national availability of highly skilled people is getting smaller. A strong STEM competency goes beyond recruiting for technical professions. In order to compete, Alcoa–Texarkana relies on all our employees applying statistical methods, problem solving or re-engineering efforts. It's not uncommon for operators and maintenance craft people to redesign and re-engineer. Our ability to succeed now and compete into the future greatly depends on our ability to recruit people with strong STEM knowledge.

Alcoa–Texarkana plays a key role in the community through its direct and indirect economic impact, Alcoa Foundation grants, and volunteer activities through our "Neighbors Committee." Communities matter to Alcoa. Our future is linked to the future of our community. Our future is also linked to the availability of a skilled workforce. It's because we understand this link that we support STEM education efforts.

Alcoa–Texarkana has played a role in educational quality encouraging young people to study math and science. These efforts include:

At the university level, Alcoa was one of the first companies to invest in the campaign to bring the College of Engineering and Computer Information Sciences to A&M–Texarkana. Alcoa Foundation grants to develop a Bachelor of Science Degree program and purchase equipment for the College.

At the high school level, Alcoa engineers participate in "Learning for Life" programs where engineers discuss science and technology careers with eighth and ninth graders. Additionally, Alcoa engineers lead "Adopt a Class" through Junior Achievement.

At the elementary level, Alcoa gave Foundation grants to support the math in the Magnet School of Arkansas with the purchase of interactive white boards. We also provided a grant for Morriss Elementary School for the purchase and use of high powered telescopes. It is our belief that the use of such equipment will help young children get enthused about math and science by seeing it in use.

I, as well as many here, want to see Alcoa–Texarkana be here for a long time. I also want to see other businesses in this community prosper into the future, giving students the tools and passion to learn more about science technology, engineering and math, which are an essential piece for making that happen.

Increasing STEM education is critical for the ability of all Americans to compete. I applaud the leadership of Texarkana Independent School District, A&M–Texarkana and the community for acting and bringing STEM education to Texarkana. I also applaud this committee for its efforts in enhancing American competitiveness and the actions it's taking to insure high-quality life for our children and grandchildren. Thank you.

Mr. HALL. I thank you, sir.

[The prepared statement of Mr. Leherr follows:]

PREPARED STATEMENT OF MIKE LEHERR

It's a privilege to be here Chairman Gordon and Ranking Member Congressman Hall and all the Members of the Committee for this opportunity to present testimony on the importance of enhancing Science, Technology, Engineering and Mathematics education.

I am Mike Leherr, Plant Manager of Alcoa–Texarkana Works. Alcoa–Texarkana is a manufacturer of aluminum sheet. With highly sophisticated mills and equipment, we convert predominately scrap aluminum into a finished rolled product for use in commercial trucks, trailers, boats, appliances, automotive, and general industrial applications. We supply customers throughout North America. Our workforce is made up of Engineers, Technicians, Chemists, and Computer Science professionals, Accountants, Operators and Maintenance crafts. Approximately 50 percent of our salary workforce has professional technical degrees in the disciplines of Science, Technology, Engineering or Math. Additionally, many of our purchased services and products require technical training and qualifications as well.

As a business leader, I am responsible for ensuring that Alcoa–Texarkana remains competitive in today's global environment; in fact, Alcoa–Texarkana directly competes with manufacturing facilities all over the world for our business. In order to remain competitive, now and into the future, the Alcoa–Texarkana workforce, as well as other businesses, must continue to find ways to apply new knowledge, develop new technologies, and implement next generation manufacturing practices. The foundation of this future must start with strong STEM education. Technology change and globalization have driven the need for higher order skill sets for today's and tomorrow's businesses.

Alcoa–Texarkana, as well as other manufacturers in the area, has increasingly found it more difficult to find and recruit highly skilled people with strong background in Sciences, Engineering, and Math. We find ourselves casting a wider and wider net to find highly skilled recruits. We also are seeing an increasing number of requests to sponsor visas for non-U.S. citizens with each professional posting. It is evident that the local and national availability of highly skilled people with is getting smaller.

A strong STEM competency is not only needed for our technical professionals but also our Operators and Maintenance crafts people. Alcoa–Texarkana continues to increase engagement of employees and rely on all our employees applying statistical methods, problem solving, re-engineering efforts. It is not uncommon for Operators and Maintenance crafts people to re-design equipment and processes. Our ability to succeed and compete into the future greatly depends on our ability to recruit people of all disciplines with strong STEM knowledge.

The STEM education program that has been developed here at the Martha and Josh Morriss Mathematics and Engineering Elementary School is exemplary. I believe this school will provide students with the knowledge, ability and most importantly, the enthusiasm and desire to excel in Science, Technology, Engineering and Math.

Alcoa–Texarkana plays a key role in the community through its economic impact, Alcoa Foundation grants, and volunteer activities through our “Neighbors Committee.” Communities matter to Alcoa. Communities hold our franchise to operate and we need their resources, infrastructure, markets, and workforce to thrive. In turn, we owe them our integrity, careful stewardship of the environment, our ability to provide jobs and community support. Our future is linked to the future of our community. It is because we understand this linkage that we support STEM education efforts. Alcoa–Texarkana has played a role in educational quality and encouraging young people to study math and sciences. We have actively supported STEM education at all levels. These efforts include:

- At the University level, Alcoa–Texarkana was one of the first companies to invest in the campaign to bring the College of Engineering and Computer Information Sciences to A&M–Texarkana. Alcoa Foundation Grants were used to develop a Bachelor of Science Degree program and purchase equipment for the College of Engineering and Computer Information Sciences Program at Texas A&M–Texarkana.
- At the High School level Alcoa–Texarkana Engineers participate in “Learning for Life” programs where Engineers discuss science and technology careers with 8th and 9th grade students. Additionally, Alcoa–Texarkana Engineers lead “Adopt a Classroom” through Junior Achievement.
- At the Elementary level, Alcoa–Texarkana and the Alcoa Foundation have given foundation grants to support Math and Engineering Magnet School in Arkansas. We also provided a grant to the Morriss Elementary School for the purchase and use of high powered telescopes. The use of such equipment will help young children get enthused about the sciences by seeing it in use. Additionally, Alcoa–Texarkana has also been in discussion with Morriss Elementary about a working exhibit on renewable energy.

I, as well as many here, want to see Alcoa–Texarkana be here for a long time. Giving students the tools and passion for learning more about science, technology, engineering, and math will be a vital piece into making that happen. Increasing STEM education is critical for the ability of all Americans to compete globally.

I applaud the leadership of Texas Independent School District, A&M–Texarkana, and the community for acting and bringing enhanced STEM education to Texarkana. I also applaud this committee for its efforts in enhancing STEM education in this country.

Thank you.

BIOGRAPHY FOR MIKE LEHERR

Mike has been with ALCOA for 17 years. He began his professional career as an engineer at Alcoa’s Warrick Operations. He held a variety of manufacturing, engineering, and maintenance assignments at Alcoa’s Warrick operations until 1996 when he accepted a position overseas in the company’s Swansea, Wales facility as Hot Mill Production and Maintenance Manager. From 1999–2005 Mike held a variety of progressive Plant Management and Director of Manufacturing roles in different divisions within ALCOA. In July 2006, Mike was named Plant Manager of Alcoa–Texarkana Works.

Mike graduated from the University of Notre Dame with a Bachelor of Science Degree in Mechanical Engineering. Mike is active in a variety of charitable, educational, and civic activities. Mike serves on the board of the United Way of Greater

Texarkana, serves as a member of the Blue Ribbon Committee for the Texarkana Independent School District. Mike is also a baseball and soccer coach for youth activities in the area.

Mr. HALL. Now we recognize David Smedley.

STATEMENT OF MR. DAVID SMEDLEY, SCIENCE EDUCATOR, NORTH HEIGHTS JUNIOR HIGH SCHOOL, TEXARKANA, ARKANSAS

Mr. SMEDLEY. Thank you, Chairman Gordon. Ranking Member Hall, and Congressman Ross. My name is David Smedley. I teach seventh and eighth grade science at North Heights Junior High School on the Arkansas side. I am fresh out of the trenches. I was there this morning. Some of the things I may say, I hope do not sound abrasive, but this is the way it is in the trenches.

The major problem that limits our teachers in the middle school years and the primary years is the broad-base of knowledge and partnerships of life and physical science. In addition, time demands placed on teachers during non-school hours for extracurricular activities and responsibilities adds stresses and pressures that have nothing to do with aiding the teacher in presentation of materials. In the middle school years many teachers are specializing in one of the three areas of science, life or physical science and do not feel comfortable and are not totally prepared to present lessons in the other areas of science.

In the primary school years, most teachers are not equipped neither academically to, nor experientially to present the science contents. It's my opinion that the single most important step that the Federal Government could take to improve K–12th grade science education is to nationally align the teaching of science content in the United States. The situation needs to be so that if a student moves from Colorado to Arkansas or any other state that the same science concepts are being taught at approximately the same time of year and to the same level of understanding at the same grade levels.

Advanced classes should also be made available. A nationwide science curriculum could be posted on the Internet for all schools to use. As students progress in the curriculum standardized test that all students in America would take would produce data used to award scholarships or grants, to help students attend colleges, universities, vocational schools or some specialty school.

In order to produce students that can compete in the international stage of science a greater degree of support in the form of resources, training, and organization needs to come from the Federal Government. This support must not be in the form of regulations and bureaucracy, but must be pragmatically directed at how these decisions will affect the individual student sitting in our classrooms.

Our school is a NASA Explorer School and receives much quality training in resources to help students prepare for the sciences. The most important and effective components of these programs is the resource and support.

After interviewing my students this week, telling them that I was going to come to speak on these topics, their opinion on how to keep them motivated was to give them engaging, hands-on activities. They also said that inspired teachers, they need inspired teachers, not just someone who's presenting the material in a very mundane way.

Students in today's classrooms are not the same type of animal they were even a few short years ago. Technology is a must in order for us to truly prepare our students for this new world and make them feel they are one of society's major foci.

Many activities that occur in my classroom are student generated. As we were studying Newton's Laws of Motion one of the classes asked if they could construct a trade machine. I didn't pretend to know what the students were asking, but instead allowed our students to use our Promethean Board large screen in front of the class and research the topic on the Internet. As the entire class reviewed the research on the large screen, greater interest was generated. To make the story short, we constructed it and were able to actually experience the Laws of Physics rather than just read about and work the math problems related to this usually boring and technical topic.

Other activities that have been huge successes in the middle school include producing products such as solar powered cars, hydrogen fuel cell cars, robotics, bridge building, basic and advanced dissections, GPS, global positioning systems units, plant growth and CGC, electric motors, electric circuits and model rocketry. In all of these units, direct application of the learning can be pointed out easily. When the students are guided in the construction of a natural working model such as a robot they're excited and motivated to have achieved success and can see some concrete product as evidence.

Another component that I believe helps me to motivate my students is I try to connect my sciences to the other content areas the students are taking. I try to build community in the classroom. Students have to feel comfortable. They have to know that their learning is connected to another student's learning. So, pure teaching and pure learning takes place among our students as they work cooperatively in small groups.

This builds respect for both the teacher and learner in this pure teaching model. As the year progresses, the teacher and the learner roles are experienced by all in some manner, and you don't know what you don't know until you try to teach someone or explain it to someone else. And as these students help each other in their problem-solving process in these hands-on activities, they gain a respect for themselves as well as each other.

Parents could better support our schools if they would simply not put down the public school system in general. Parents need to make sure their students have the simple necessities of food and rest that young people need to learn.

Parents can try to provide a stable environment by remaining the primary caregiver for the child and not placing the responsibilities of raising the child on some aunt, uncle, grandparent or a babysitter. The community can help if they become involved in providing learning activities outside the school building.

Businessmen and women could come speak to students and show how their job as well as the social skills of these students need to learn.

In summary, what I need as a public school teacher is support, resources and training, up-to-date training, and continual training. It's hard to keep up with all these technological advances and methods of presentation. Some of the best teachers that we have that can contact with the students the best are left behind as veteran teachers with technology. New teachers are coming in, but they don't have the experience and can't make the same type of contact as the older teachers, so we need up to date and on-going training. Thank you very much.

Mr. HALL. I thank you. We needed you as a part of this panel to complete the circuit for the information that's needed. You're at the helm. You're fresh there. Thirty, 45 minutes ago you were probably with your students. We thank you for coming here.

[The prepared statement of Mr. Smedley follows:]

PREPARED STATEMENT OF DAVID SMEDLEY

1. What are the major problems that limit the performance of students and teachers, and what do you feel is the single, most important step that the Federal Government should take to improve K–12th grade math and science education? What involvement have you had with math and science education programs at the National Science Foundation or other federal agencies as well as those in the State of Arkansas? What are the most important and effective components of these programs?

The major problem that limits the performance of students in math and science is mostly the attitudes of the students themselves. Students seem to think that learning is always going to be quick and easy. When the content is new or challenging and the students find it difficult, most of the time the students simply give up or quit. The major problem that limits the performance of the teachers in science is the broad base of knowledge required to teach life, earth, or physical science. In addition, time demands placed on teachers during non-school hours for extra-curricular responsibilities add stresses and pressures that have nothing to do with aiding the teacher in the presentation of academic materials. In the middle school years, many teachers have specialized in one of the three areas of science and do not feel comfortable and are not totally prepared to present lessons in the other areas of science. In the primary school years, most teachers are not equipped neither academically nor experientially to present the science content. State mandated assessments in the State of Arkansas have just now, in the last three years, been put in place for our students. This assessment does not include any lab performances to be done by the students. It is my opinion that the single, most important step that the Federal Government should take to improve K–12th grade science education is to nationally align the teaching of science content in the United States. The situation needs to be so that if a student moves from Colorado to Arkansas or any other state that the same science concepts are being taught at approximately the same time of the year and to the same level of understanding at the same grade levels. A nationwide science curriculum could be posted on the Internet for all schools to use. As students progress through the curriculum, standardized tests that all students in America would take could produce data which then could be used to award scholarships or grants to help students attend colleges, universities, vocational schools, or some specialty school. In order to produce students that can compete in the international stage of science, a greater degree of support in the form of resources, training, and organization must come from the Federal Government. This support must not be in the form of regulations and bureaucracy, but must be pragmatically directed at how these decisions will affect the individual student sitting in our classrooms. My experiences with the National Science Foundation are very limited. Associations with our local educational coop, the Arkansas State Science Teachers Association, and the National Science Teachers Association provide our teachers with opportunities for training and limited resources to aid in the teaching of science content. Our school is a NASA Explorer School and receives much quality training and resources to help present science to the students. The most important and effective components of these programs is the resource support.

2. How can we spark a greater student interest in math and science education? What can we do to ensure that student interest in math and

science does not wane as they progress through our formal system of education? Specifically, how do you keep your junior high students motivated and excited about STEM?

After interviewing my students this year concerning this question, I found that their opinion on how to motivate students in the sciences and keep their interest points to the fact that providing engaging activities is the key. Students in today's classrooms are not the same type of animal they were even a few short ten years ago. Technology is a must in the classroom in order for us to truly prepare our students for this new world and make them feel that they are one of society's major foci. Our society places its money where the priorities lie and our schools are being cut short. Teachers that are inspired about their content was also mentioned as a factor in motivating the students themselves. It is my opinion that teachers must be ready to "perform" for the students.

My personal experiences in teaching have shown me that if students can see a direct link between what they are studying and some real-life situation, then they have more motivation to learn. Guest speakers, field trips, and special presentations by other professionals in their field tend to increase the level of interest in students at all grade levels. I keep my junior high students motivated and excited about STEM by showing the connections between what I ask them to do and what they are going to need to be able to do when they enter the job market and adulthood. Many activities that occur in my classroom are student generated. As we were studying Newton's Laws of Motion, one of the classes asked if they could construct a trebuchet. I didn't pretend to know what the students were asking, but instead allowed a student to use the Promethean Board and research the topic on the Internet. As the entire class viewed the research on the large screen, greater interest was generated. To make the story short, we constructed our trebuchet and were able to actually experience the laws of physics rather than just read about and work the math problems related to this usually boring and technical topic. I try to bring the teaching to life in my classroom. Other activities that have been huge successes are: solar powered electric cars, passive solar ovens, robotics, bridge building, basic and advanced dissections, GPS (global positions systems) Unit, plant growth from seed to seed, electric motors, electric circuits, and model rocketry. In all of these units, direct application of the learning is pointed out. When the students are guided in the construction of an actual working model such as a robot, they are excited and motivated to have achieved success and can see some concrete product as evidence. In these activities, students are required to measure, read and comprehend, and move through the problem solving process in order to succeed. This is another component that I believe helps me to motivate my students. That is, I try to connect the sciences to the other subjects the students are taking. Completing a reading comprehension activity with the use of science content and calculating a percentage grade requires the students to engage their literacy and math skills in daily class activities. At the beginning of the school year and various points throughout the year, I try to build community in the classroom. The students must be made to feel comfortable in the classroom in order to learn. The students must feel that both their learning and the learning by others in the classroom are connected. Peer teaching and learning takes place among the students as they work cooperatively in small groups during many of the learning activities. This builds respect for both the teacher and the learner. As the year progresses, the teacher and the learner roles are experienced by all in some manner. In summary, I keep my students excited and motivated about STEM by being real and understanding with the students on a personal level and by being challenging and inspiring on a professional level.

3. What challenges do you face in improving student achievement in math and science education? How can parents, businesses, the community, and the government better support you in your efforts to raise student proficiency in STEM?

The challenges faced by teachers in improving student achievement in math and science education are multi-faceted. Concerning the assessment tool that indicates the level of achievement in the State of Arkansas, I feel that the data obtained from this exam is totally unreliable. It a basic learning principle that states in order to learn the learner must be ready to learn and see the need to learn. We are assuming that students will perform their best when given the opportunity just because of their own intrinsic values. Students need to be given a reason to pass this test. Retention at grade level or remediation before passing to the next grade level might possibly work. It is very assuming and in my opinion a very false assumption for us to think that young people will perform at a high level of achievement without a reason other than it is what they "should" do! Our schools are being held account-able to a high degree relative to the test scores of the students, but we are not placing any accountability on the students. Challenges of the mind-set of the student when they arrive at school from a family setting that may not be a peaceful or a healthy environment also require attention and understanding from the teacher as it presents its own set of challenges.

Parents could better support the schools if they would simply not put down the public school system in general. Parents need to make sure that students have the simple necessities of food and rest that young people need to be ready to learn. Parents could try to provide a stable environment by remaining the primary care-giver for the child and not placing the responsibilities of raising the child on some aunt, uncle, grandparent, or baby sitter. The community could help if they would become involved in providing learning opportunities outside the school building. Business men and women could come and speak to the students about how what they are learning in the classroom will be applied in the job market. These individuals could also make the students aware of the social skills and behaviors that will be required to become a successful employee in their chosen field. As stated earlier, I feel that the government needs to step in and provide positive leadership and assistance for the states through finances, training, and academic alignment of the sciences in our public schools.

4. What elements of your pre-service or in-service training have been most helpful in meeting the daily demands of working with students, developing innovative classroom strategies, and delivering content-rich instruction to students of all levels and abilities? As a professional teacher, what partnerships or collaborations with local colleges or universities have been most helpful to you in terms of access to materials or professional development?

One of the important elements of my in-service training that has been most helpful in meeting the daily demands of working with students has been the National Science Teacher Conventions that I was able to attend. This gathering of science educators from all levels of education has provided me with many, many tools in my box. I have been able to use methods and techniques of presentation that were presented during these conventions. I have made connections and created a support network from teachers all over the United States. Stimulating activities and projects that I have modified have proven very successful for my students. These ideas and innovations were all initiated from meeting with other professionals in these workshops as well as informally in the down time of the conventions.

In-service trainings that keep veteran teachers up on the latest technologies that are available for the classroom have been most valuable. As technology has progressed over the last ten to twenty years, some teachers have been overwhelmed by new methods of using the technology to present content. It is vital that science teachers at all levels keep up to date on current technologies and information. This is also something that the government could help to provide as they ensure that good, quality in-service workshops are available for all teachers at the appropriate grade levels. At this time, we do not have any partnerships with the local colleges and universities to help with access to materials or professional development.

BIOGRAPHY FOR DAVID SMEDLEY

Education:

- High School Diploma—Arkadelphia, AR—1973
- Honorable Discharge—United States Marine Corp—1975–79
- BSE—Henderson State University—1981
- MSE—Henderson State University–1989
- Areas of Certification—Arkansas
  Biology/General Sciences, Health, Physical Education, Coaching
- Certified by the College Board for Middle School Science
- Certified by International Baccalaureate Program—Middle Years Program
- Arkansas Leadership Academy trained

Career-Related Experience

- Science Instructor—Life Science, Earth Science, Physical Science, Biology—Delight High School—1981–90

- Head Baseball Coach, Asst. Basketball Coach—Delight High School—1981–90
- Health Instructor—12th Grade—Delight High School—1981–90
- Anatomy & Physiology—organized and implemented this new curriculum into Delight High School as standards created the need for new science content Offerings—1986–90
- Science Instructor—8th Grade—North Heights Jr. High School—Life-Earth-Physical—1995–2000
- Science Instructor—Earth Science—North Heights Jr. High School—2000–05
- Science Instructor—Life Science—North Heights Jr. High School—2000–05
- Science Department Chairperson—North Heights Jr. High School—1997–2005
- Science Instructor—North Heights Jr. High School—International Baccalaureate/Advanced Placement Program—2005–08
  Integrated curriculum—Life, Earth, and Physical Science

Other Work Experience:

- Arkansas Mentor Program for novice teachers training for the Praxis III Assessment
- Team manager for Destination Imagination teams at the State level
- Co-Chair for the North Heights Leadership Team
- Creator and sponsor for the North Heights Chess Team

Grants and Awards:

- University of Wisconsin—Orbital Space Laboratory—(2000–05) $2,500
- Teacher Take Wing Grant (2000–2002–2007) $1,500
- American Power Company (2005 and 2008) $1,000
- KTBS One Class at a Time Grant (2003 and 2008) $2,000
- Weyerhaeuser Environmental Grant (2005–2006–2007) $1,500
- Texarkana Arkansas Education Foundation Grant (2004 and 2008) $2,500
- North Heights Jr. High School Teacher of the Year—(2003 and 2008)
- Recruited $1000 in funds from local businessmen to support the chess team

Mr. HALL. I've recognized the Mayor and former Mayor. Were there other public officials? I thought I saw Judge Carlow come in here a while ago. Judge, are you here? Stand up and let us recognize you.

He works day and night. I don't know what he does for the county here, but I know that he works for people in this county because he's working now to get some of the Red River land. The Secretary of the Army is going to grant it to somebody. He's got a group that's pushing hard to get it. They pushed right up to the brink several times and almost had it, and they're still pushing.

One other thing, as Mike Ross knows, there was a provision a year and a half ago, in the energy bill to encourage every state to build a refinery. Refinery is one of the major reasons our gasoline is going up to four and five, six, seven, eight, maybe ten bucks before it's all over if we don't do something about it. It had some benefits for each state and encouragement for each state to build a refinery. We're trying to be the one to build that refinery right here. The judge is giving us good leadership in that.

As a matter of fact, somebody pushed him around a little bit and told him well, you don't have access to ocean travel. He said yeah, we don't have any hurricanes either. Pretty dog-gone good answer. Pretty tough guy. Are there other public officials here? Thank you.

We have Mr—now we get to ask some questions for five minutes here, and y'all can put the clock on us. We thank you for your testimony. It was well given. We're grateful for it.

We have—Tom Pickens is one of the additional Members to the panel. I guess I want to ask him to expand on the K–12 education and how important it is to have students as prepared as these young students look like apparently are going to be. Can you give us a little—and what you think about what you've seen today in Texarkana, Texas.

STATEMENT OF MR. THOMAS B. PICKENS, III, CEO, SPACEHAB

Mr. PICKENS. Thank you, Congressman. As the CEO of SPACEHAB, we are one of the very first, I think we are the first commercial provider of space-related services to the International Space Station via the Space Shuttle.

In reviewing and going through the school today, I'll use a contemporary term, I was blown away. I have never seen anything quite like this, the importance of it. I guess the part that really caught me by surprise, and very sincerely by surprise, was the robotics lab. When we look at space and where we're going and doing in space, I recognize as a leader of this company SPACEHAB that that is really the future of engineering if, it's the future of mathematics, it's the future of science. That is our Magellan trap as future generations trek forward. To see these youngsters in here learning how to use robotics, I know because our analysis ended up telling us so, that that is also a big part of that future in space.

The radiation problems there in space are insurmountable. They're almost impossible to solve. We'll probably figure it out somehow, but so far we haven't. That means that robotics is going to do most of everything that we have as a future in space. The work that was being done at the school was right in line with what the future of space and space engineering is going to be.

Mr. HALL. Thank you.

DISCUSSION

Mr. HALL. I yield as many minutes as the Chairman would like to have to make any inquiry to the panel or Mr. Pickens. It's important that giants in the industry come to Texarkana, Texas to see what's happening here and take that message back to other places you go. We thank you for your time which is very, very valuable, and Dr. Stripling for your trip down here to let the word go forth as to what you see here and what people can do when they forget who gets the credit for it and just want a product for their children by golly. Thank you again for coming, and others of you who are local here, you're on the job day in and day out. You're elected so you're bound to be the best.

I yield five minutes to the Chairman. By golly, every now and then he holds me to five minutes in Washington. I'm going to put the clock on him. If he goes over I won't be too hard on him.

Chairman GORDON. Thank you, Mr. Hall. One of the things that we learned from the report, *Rising Above the Gathering Storm,* was really disturbing, and that is that approximately 63 percent of the math teachers in our middle schools have neither a certification to teach math or a major in math. Ninety-three percent of the physical science teachers have neither that certification or a major, so it's hard to teach a course and have passion in a course if you don't have that core background, no matter how good a teacher you might be.

I say that not doubting teachers. My mother and father were both teachers. My father was a farmer and after World War II he went to school on the G.I. Bill. Then my mother was working at the cafeteria. He got the last teaching job at Smyrna High School in our county.

We passed the COMPETES bill with an effort to try to take care of that. Part of what we did is we set up a scholarship for those students that would go into math or science and education and agree to teach for five years. We also set up scholarships for teachers like my father who would come back in the summers to get that certification or AP or whatever it might be. And that's good. I think it's positive, but we have to get kids interested in that education beforehand. So, Dr. Marrett I know that NSF is doing a lot of research on those types of teaching processes and professionalism, but what are you doing to get that out to the thousands of school districts and schools all across this country?

Dr. MARRETT. We hope to do a lot more. A hearing like this helps a lot as we both can explain some of the things we are undertaking, but also hear what else we need to be doing.

We have enhanced our efforts to explain and get more people involved in STEM education. The program you just mentioned, the Noyce Scholarship Program is in fact a program that takes students during their undergraduate years who are majoring in the STEM areas and seeks to attract them into the teaching profession. That's been a very interesting and successful program. We could certainly have more places asking about and applying to that program than in fact takes place right now. So we are seeking to enhance information about an effort like that.

We also have a program at the graduate level. There is a program, Graduate Teaching Fellows for K–12, where we take graduate students who are in the STEM areas and who want to have a chance to work with K–12 teachers. They then move into classrooms. So, what we've found out from that is that they learn a lot about the whole teaching experience, about the challenges, about the opportunities.

In many respects we have a number of efforts underway in which we would appreciate even more inquiries being made of us and suggestions about new efforts or the ways in which the ones we are undertaking could be improved. We invite at all times comments and suggestions about our portfolio.

Chairman GORDON. I think that's one of our challenges, not only to create these programs, but as we all know the tree doesn't fall if you don't hear it. Often times it's those poorer school districts that are the ones that have the least resources to be able to find that.

Also, Mr. Russell, when you were setting up this school here, you were able to cast out a wide net and bring in special teachers. As you said, they were required to be master teachers. That's fine and good for here, but what about all the other schools? What are your suggestions on how we can raise that level of teacher education in the schools that aren't the model?

Mr. RUSSELL. I think it is the most critical thing because we all know a nice facility like this, all of the nice supplies and curriculum is wonderful, but we also know the most important thing is the highly qualified classroom teacher. Bottom line, if you have that great-driven teacher with passion, they can be in an importable building with a box of chalk and they are going to be extremely successful. So, that is key number one. And that's an initiative for Texarkana I.S.D. We're not limited just to this school. Number one, we pay all of our teachers more if they obtain that master certification. On top of that, we actually pay——

Chairman GORDON. That's master certification in whatever course? It could be history or whatever it is?

Mr. RUSSELL. Absolutely. If you have your Master's degree, you're on a higher pay scale. Obviously we value education and know that it does make you a better person the more you receive.

We also pay for the teachers to get their Master's degree. We are doing 20 to 25 a year in the district where they enter a program where the district actually pays for that Master's program. It does that for our Morriss teachers. It also does it for district wide. So again, that's just a great length to great teaching that we have seen.

Another one, the great partnership with Texas A&M and Texarkana. They actually developed a curriculum of instruction Master's degree just for the department of the school district and then added this Master Mathematics Certification for the teachers at Morriss.

We all know people that are incredibly smart that can't teach very well, so not only are we teaching the teachers more about the subject and experts on that, the University has also designed delivery courses so when they have that higher knowledge they can bring it down to the students and make it successful. So we recognize that as value added across the district, and that's exactly what we're doing and would highly recommend that to anyone. Our master teachers are the ones that typically stay in the district a longer amount of time. They're happier.

I think just like the kids sometimes that are afraid of just the words math and science to go into the hard subjects, I think it's true for adults too. I think when you have an education program that is going to help your adults get more comfortable in what they're teaching then you just see more success all the way around.

Chairman GORDON. Thank you.

Mr. HALL. I recognize Mr. Ross for five minutes. Mr. Ross.

Mr. ROSS. Thank you. Thank you Ranking Member Hall and Chairman Gordon. As you look at this panel, we've got someone with NSA, we've got a school administrator, we've got someone associated with the local college, a manufacturer, which is very important, someone that's in the space stuff, Mr. Pickens.

I meant to say this in my opening statement, I want to thank David Smedley for taking time out of the classroom to be with us today. He was my contribution for the panel. We're delighted to have him from the Arkansas side. As Mr. Hall mentioned, he's a renowned science teacher at North Heights Junior High in Texarkana, Arkansas, has a Bachelor's and Master's degree from Henderson State University, which is also in my Congressional district Arkadelphia, and has been in the field of science for 25 years.

One of the things that I think is important to know is that this year he was named North Heights Junior High School teacher of the year, an award he also received back in 2003. I think that speaks volumes about you Mr. Smedley and your commitment to our children. If you were a Member of Congress, and I hope you don't want to be any time soon. If you were a Member of Congress, what are one, two or three things that you think from a federal level that we could do to try and help provide the teachers with whatever it is they need to help grow a new generation of innovators in this country and really get them focused on the maths and sciences?

Mr. SMEDLEY. Could you repeat that question? Thank you. Thank you. I think that—I don't know if it's actually a feasible idea, but level the playing field. As I came to this school this morning and walked up here, I had to ask, "Is this a public school?" This school is awesome, but it's not the public school that the majority of our schools are. The majority of our schools are plagued with violence and drugs, and this is middle school. These are middle schools, but resource wise if we could just level the playing field, the Texas side versus the Arkansas side.

I was raised up the road aways and didn't really know until I came down here the—it's not—well, it's not a rivalry, it's not a hatred, but it's a very strange situation that goes on here as far as seeing the difference in resources between the two states.

Arkansas is a wonderful state and I love it very much, but to think that if I were to come across the street and do the exact same job for $5,000–$10,000 more, money is an enticement. If we could just level the playing field somehow as far as in numbers, resources and pay, pay scale.

This Internet curriculum that I suggested, that would—that would get all of our kids on the same page at the same level as far as science content goes. I really feel like the Federal Government's—and again, I'm not sure of all the technicalities or whether they could actually do it, but the Federal Government I think could come in with a curriculum with activities.

There is a company called Science Education Public Understanding Program which has kits for each content area, and our teachers do not have resources. And I thank God that I'm not in that portable building with the box of chalk anymore. I was there. I was there, and I was the resource.

Resources and continual training and somehow level the playing field so that poorer states and poorer students do not—there are a lot of students and scientist that we are losing simply because they're poor and they can't afford to go to college. They don't have that privilege or that honor. They didn't get that scholarship they needed, or one thing or another happened. Level the playing field between the states and encourage the teachers to continue their trainings to stay up to date.

Science, you know, it changes so fast nowadays. I tell my students in the classroom what was science fiction when I was their age is science fact today. I try to inspire them into futuristic thinking and say what is your science fiction today that you dream might be science fact tomorrow.

So, those things that I think you could do, level the playing field, continual training. Thank you.

Mr. ROSS. I see the red light Mr. Chairman, so I assume my time is up.

Mr. HALL. I kept in mind that you would have the gavel over the entire Congress. I will let you go as long as you wanted to.

I looked at Dr. Marrett when I thanked Dr. Stripling a while ago for coming so far. I had Dr. Stripling on my mind. I was going to ask her some questions. I apologize to one of you if—I looked at one and was thinking about the other one. That happens a lot to guys my age.

As a matter of fact, can I take time to tell a story Mr. Chairman? Show you how people can make mistakes. There was a Michigan woman and her family vacationing in a small community one time where Paul Newman and his family often visited. One Sunday morning the woman got up early to take a long walk, and after a brisk five-mile hike she decided to treat herself to a double dipped chocolate ice cream cone. She hopped in the car and went straight to the combination bakery ice cream parlor. There was only one other patron in the store, Paul Newman sitting at the counter having a doughnut and coffee.

The woman's heart skipped a beat as her eyes made contact with those famous baby blue eyes. The actor nodded graciously and the star-struck woman smiled. Pull yourself together she said to herself. You're a happily married woman with three children. You're 45 years old, not a teenager.

The clerk filled her order and she took the double dipped chocolate ice cream cone in one hand and her change in the other. Then she went out the door avoiding a glance in Paul Newman's direction. When she reached her car she realized she had a handful of change, but her other hand was empty. Where is my ice cream cone? Did I leave it in the store?

Back in the store she went, expecting to see the cone still in the clerk's hand or in a holder on the counter or something. No ice cream cone was in sight. With that she happened to look over at Paul Newman. His face broke into his familiar warm friendly grin. He said to the woman, "You put it in your purse." So I know—Dr. Marrett, I know you're not Dr. Stripling, by golly. I'm thankful you're not. I'm thankful both of you are here. We've got two of you.

I'm going to exceed the five minutes just a little bit, but Dr. Stripling I want to ask you, what's the status of the think tank that you all are involved in with in UT–Dallas, Baylor, Princeton, and Texas State on replicating models like Morris?

Dr. STRIPLING. Well, I'm glad you asked that question because the group is coming to Texarkana I believe next Friday. First of all, let me describe that. A couple years ago Texarkana I.S.D. leadership, representatives from A&M–Texarkana, Princeton University, University of Texas–Dallas, Baylor University and Texas State Technical College started coming together, and really it is a tree think tank. That is the agenda each time.

We first—well, I don't think I participated in the very first meeting, but we were in Waco one time. We were at TSTC at Baylor.

The group came here last fall. The whole effort of this group is to think about, really as a think tank would, how we can replicate models similar to the collaboration here in Texarkana and other sides. I know Dr. Hensley is actually planning to have an Ohio Texas STEM meeting at the University of Texas–Dallas in mid-May, I believe. So, that's the status, we're moving along.

Mr. HALL. Have you—are you familiar with the You Teach program at the University of Texas?

Dr. STRIPLING. Yes, I am.

Mr. HALL. Have y'all considered reaching out to them maybe to be a part of this think tank and the Texas A&M and the University of Texas work together on something together like that possibly?

Dr. STRIPLING. I think we probably could. This is not a closed door group at all. We are willing to take anyone who is willing to jump in as a collaborative partner and work toward this end.

Mr. HALL. Good. And I thank you. I want to ask Mr. Pickens a question.

A lot of family, I guess many, many families across this country live in hope that their cures have eluded all of us for centuries. We more than hope. We have prayers. We also have one other thing. We have people and men and women that are doing research that are hammering for breakthroughs. I guess my question to you is, do we have any reason to believe that through your leadership at SPACEHAB and after listening to your wonderful speech at noon today, is there hope for those of us who have diabetes, Alzheimer's, cancer, Lou Gehrig's disease. I have in my family progressive super nuclear palsy for which there is no cure. Is there hope for us in the work you're doing at this time? If so, take the rest of my time and tell us about it because we want to hear that.

Mr. PICKENS. Congressman, I wish I had a whole day to talk about this. This is the most passionate thing I've ever run across in my life. When I got into SPACEHAB I was a board member, and I maneuvered myself as to become the CEO for just exactly the reason that you're pointing out.

When I looked at it, SPACEHAB had been sending up science for 23 years on behalf of NASA and I saw five and a half billion dollars of money that had been spent through that whole process of sending science to space. When President Reagan in 1984 first discussed with the Nation about the idea of building an international space nation, the intent and the desire at the time in a 1984 State of the Union address was to enhance and save lives on Earth. That International Space Station will be complete in two years. In the meantime, Congress has made sure that NASA has set science up in preparation for that date of completion of 2010 for the ISS and made them send things up to observe what it was like in microgravity and the differences that it would be like here on Earth.

In that, the comparison ended up showing very definitely there is a lot of value. The value came in two big areas, and there are other areas. I apologize if I leave out some of those areas people feel passionate towards. But the one big area is vaccines. You can grow a vaccine in a petri dish here on Earth, and you can try and try and you can try for years and years and years and years and you'll never get anywhere. And yet, we just flew the salmonella vaccine that will end up enhancing and saving lives on Earth, just exactly what President Reagan intended in the very beginning, the stages of the ISS intended.

The other area is what's called protein crystal growth. I won't go into what all that means, but it's a very complex system of how you develop a drug that will treat something that is as sinister and is as hard to decipher as diabetes, Parkinson's, Lou Gehrig's, sickle cell anemia, you name it. That's the tough stuff. The things that we haven't solved, the things that we haven't gone any forward, nothing has happened if you think about it. What has really changed with millions and millions if not billions of dollars that have been spent in those areas of drug discovery that we can really point to? Nothing. There are some treatments on the edges of making people feel—I think Parkinson's has had some advancements lately, but it's really kind of slowed it down; hasn't really treated it. In space they find out that they can do that.

Now, NASA has been building space stations. They have been also doing some science. I give the analogy that to do an experiment in space up to now while they were building the station was like doing open heart surgery on the back of a bulldozer in the middle of a construction site building a sky scraper. If you went into a construction engineer and said I'm going to go do some open heart surgery in your construction site he would tell you that you're crazy. And that's where we've been doing science today. They have done a pretty good job of it though, and they found out that there was a lot of opportunity for value to bring down and enhance and save lives on Earth, but it wasn't in the right type of atmosphere and the right type of conditions to really get the best you could possibly get so I think that's where we're headed in SPACEHAB is to go off and develop those and discover those. And I think there is a huge amount of opportunity in those areas, Congressman.

Mr. HALL. I thank you. My time's up, or I would have a follow-up for you. Mr. Chairman, do you have—go for it.

Chairman GORDON. I just have one quick question for Mr. Pickens. You have become involved through STEM education through your STARS program. Any lessons learned there you want to share with us?

Mr. PICKENS. The STARS program is where we involve children from all over the world. As a matter of fact, mostly from the United States to send experiments up in our SPACEHAB science modules. They're no longer flying the science modules any longer. With the construction of the International Space Station being the primary importance of the Shuttles right now, there is no room.

There is discussion, however, that they would extend flights of the Shuttle that would include the science module, and I would encourage that because that is waiting. There are lots of kids with experience who were approved by NASA. They are ready to fly and they are very, very interested in doing that. It really brings the kids into the game.

I was watching on the ISS the other day where they had a microphone and they were talking to some of the astronauts up there to the students down on the ground, and it was great, and it was fine, but if they had experiments up there, that would be really, really great. If they had had robotics up there that they control on the

International Space Station with cameras on it, that would be incredibly great. That's where we need to go with this ISS facility that we've spent a hundred billion dollars on.

Chairman GORDON. Thank you. If you'll back the balance of my time.

Mr. HALL. Mr. Ross.

Mr. ROSS. Dr. Marrett, thank you for joining us here today. Do you believe that we're doing a good job of getting resources? Mr. Smedley talked about hands-on materials to work with the students. I know NSF has some programs where they can provide materials, grants for equipment. Are we doing as good a job as we should be, or what should we be doing different to try and get those materials and those grant opportunities out and to the public schools and get more math and science teachers aware that they exist?

I know I came back inspired by some of the work NSF was doing at the South Pole, and I put together a package to send to science teachers in my district, but are we doing a good enough job of getting that information and that knowledge from Washington to the school districts across the country to try to help grow a new generation of mathematicians and scientist? What could we be doing differently?

Dr. MARRETT. Our answer in terms of are we doing enough is no, we're not. I do have some ideas about some other things that we should be undertaking and undertaking collectively. It's not just the National Science Foundation.

We're working collaboratively with other federal agencies. We need to be a much stronger connection with a number of foundations and other places. We're working with all of these institutions. I do want to thank you, however, for your comments that you made about the experiences at the South Pole. As you know, the National Science Foundation operates the set of activities in Antarctica, and we've seen what a difference it makes as students learn a lot about what's taking place on the continent that few people know very much about.

Let me illustrate with a little side story. There is a teacher from Harlem who will be going in the next season to Antarctica. She describes what this has meant to her students in her middle school science class. They began to have a great deal more interest in questions about climate, questions about what the world is like because they suddenly had a connection with someone who would be pursuing the topics of interest to them, generating that kind of interest. We found what that kind of activity can mean. I just want to thank you for bringing this possibility to our attention, by your reference to the South Pole.

In terms of the kinds of activities where other resources can be developed, within the National Science Foundation, we're really working more to see how to bring the activities together. I happen to be in charge of the Directorate for Education and Human Resources. There are seven other directories that are very much concerned with developments in the disciplinary areas. Everyone of the Directorates has education programs, outreach programs, and often are looking for effective ways to work with schools, to work with museums. Our task then becomes to work in collaborative ways so that we've got some cohesive materials and ideas that we can share, but we also have to listen to know what are the contextual conditions. A key question: What are the circumstances under which materials and ideas can be used most effectively?

I want to thank the panelist and Mr. Smedley in particular for drawing attention to how whatever we do it will have to be in the context of the real world in which teachers, students and others are operating.

Chairman GORDON. Mike, if you would yield just a quick moment. The Science and Technology Committee has voted our website is the best website in the House of Representatives as well as the Senate. One thing we tried to do there is put in links to NASA, to NSF, to every group that we could where we could find lesson plans, we could find any type of a link to education from all levels. So, I would suggest that those of you in administrative positions and elsewhere communicate that. And it's is *www.science.house.gov.* It really is a central location for a lot of information.

Mr. HALL. Thank you.

Mr. Leherr, let me ask you this question. We're interested in youngsters here today obviously. That's what this is all about. You're with Alcoa. You all do have intern opportunities for high school students, do you not?

Mr. LEHERR. Currently no, we don't. We're not allowed to employ folks under the age of 18. We do have intern opportunities though for college age.

Mr. HALL. Would you offer local scholarships to students who were interested in studies that might fit your company or might be good students to work for your company upon finishing internship and then getting their education here at Texas A&M–Texarkana?

Mr. LEHERR. Congressman Hall, you're putting me on the spot, but I think definitely smart business leaders here——

Mr. HALL. Chamber of Commerce told me to put that last part.

Mr. LEHERR. I think smart business leaders would not only offer scholarships and internships and be part of the university and the STEM education. Obviously, somebody that employs a lot of engineers, I think there is one football coach that has a bunch of blue chips year after year.

Mr. HALL. I thank you. I have one other question for—if Mr. Chairman will allow me—to Mr. Russell.

Mr. Russell, we were worried about students who get well-rounded education not going into math and science. That's across the country, that's the fear. Everybody's talking about it. We're trying to encourage them, tell them how wonderful it is and try to get them in there.

Now, you all have gone to great extents to entice them, and you've enticed them. Now, that you've got them, how do you ensure that the students at Morriss Elementary are receiving a quality, well-rounded education incorporating non-science and math subjects where they won't be math and science nerds? Is there any better way to ask it?

Mr. RUSSELL. No. That is an excellent way. In fact, Ms. Morriss asked that question before she would allow us to put her name on the building and we had to beg her to allow her to do that, because she has quite a passion in the fine arts and again would not allow her name on a building that did not take great strides to do that. If you will look at the stage that you're sitting on right now and all the lights and the sound equipment, if I could talk all of you into coming back to the next program of the students here in the fine arts you would see that that is very important here.

It's just more of a flare that we may in some of the programs that the kids are putting on, the dramas, the plays, the musicals, you may see a science and engineering flare to it, but all those programs are so important, especially at the early ages. As you heard, we're taking our academy approach to sixth grade at the middle school next year then moving up. All of the academies are designed to where if you don't like the science and engineering this year, the health science or the fine arts or leadership you can switch to next and still be on line.

The math will be one of the toughest ones because we are advancing our math courses to where you will actually be ready for calculus by 11th grade so you can have Dr. Green's engineering classes in 12th. We're really designing everything all the way Pre-K through 16. So as the kids' interest change they can flow between academies and still be okay. So, while we are concentrating more and have much more of a flare, it's not at age five you're all of a sudden deciding what you want to be at 23 and you're locked in and hurt and not well rounded otherwise.

Mr. HALL. Okay. I thank you. Do you have other questions Mr. Ross or Mr. Chairman?

Chairman GORDON. Mr. Hall, I just want to thank you for pulling this hearing together. It's been very informative for all of us. I thank Texarkana, both Texas and Arkansas for the hospitality you have shown us while we've been here. Hopefully we can take back some of these lessons learned and help other communities.

Mr. HALL. I want to thank everyone, all the witnesses who testified before the Committee today. This has been a highly educational hearing for everyone here. Our witnesses have given this community a lot to consider. I also would like to once again thank the Committee Chairman Mr. Gordon for making the trip to Texas, and to Mr. Ross for joining us on this side of town. We all have gratitude for Marjorie Chandler, my office and my district staff, and Tina Veal Gooch with the Texarkana Independent School District for all of her hard work, and Bess Caughran for accompanying the Chairman here and keeping his books straight and writing out questions and intelligent things for him to say.

So, if there is no objection, the record will remain open for additional statements from the Members and for answers to any follow-up questions. The Committee may ask of the witnesses without objection. It is flat so ordered. Hearing is now adjourned.

May I have one exception. If you'll all sit back down I just want to ask you to do one thing. I'd like for you two folks to stand up back there. Josh and Martha, please stand up.

[Whereupon, at 2:53 p.m., the Committee was adjourned.]

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